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# Science at Work for the Farmer

*Experiment station and commercial seedsmen examining experimental plantings of new "Baby Lima" varieties at the substation at Ridgely.*

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## FIFTY-FOURTH ANNUAL REPORT

## OF THE

## AGRICULTURAL EXPERIMENT STATION

## 1940-1941

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The Station is located on the B. & O. R. R., City and Suburban Electric Car Line and the Baltimore-Washington Boulevard, eight miles North of Washington, D. C. Telephone—Warfield Exchange.

Visitors will be welcome at all times, and will be given every opportunity to inspect the work of the Station in all its departments.

The Bulletins and Reports of the Station will be mailed free of charge to all residents of the State who request them.

ADDRESS:
AGRICULTURAL EXPERIMENT STATION
College Park, Maryland.

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*Dean of Graduate School.
†On leave.

*To the Governor of Maryland, the Board of Regents,*
*and the President of the University of Maryland:*

I transmit herewith the Fifty-Fourth Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1941, and a statement of the receipts and disbursements for the same period.

R. B. CORBETT,
*Director.*

UNIVERSITY OF MARYLAND
AGRICULTURAL EXPERIMENT STATION

Volume 54 (Bulletin No. A7*) 1940-1941

# Science at Work for the Farmer

Being

## The Fifty-Fourth Annual Report

For the Fiscal Year ending June 30, 1941

*By* R. B. CORBETT, *Director*

### A WORD TO THE FARMER

THIS Report represents a change from the earlier reports of the Maryland Agricultural Experiment Station. While it is written for two audiences, its primary purpose is to give an accounting to farmers. It also gives scientists working in other agricultural experiment stations an outline of the work and so an opportunity to follow up any lead on which they desire further information. Thus, while it includes some mention of all of the work, each description is written with a minimum of technical terms and language.

The Maryland Agricultural Experiment Station belongs in a very real sense to the farmers of Maryland. It was established to help farmers solve their problems. The object of the Station is to bring present day scientific knowledge to bear in the solution of these problems.

Agriculture is made up of many small businesses. None of these is large enough to employ men to do research on a private basis. The State and the Nation have recognized the great need of farmers for scientific information and have established agricultural experiment stations in each state. These stations bring to the farmer the assistance of highly trained men who can throw the weight of this training into the solution of practical, everyday farm problems.

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*Contribution No. 1821 of the Maryland Agricultural Experiment Station.

At the present time there is a national emergency. While agricultural research is important in normal times, it becomes much more important in such a period. The world is crying for food and this cry will increase with each day that the war continues. Under such conditions it is an absolute necessity that disease-free flocks and herds, and disease-free plants and trees be maintained. It is essential that every economy of production be exercised. Labor is difficult and often impossible to obtain. Knowledge of how to grow crops with the least labor, and with the greatest efficiency, is imperative. The emergency gives the work of the experiment station a new importance and demands that each worker redouble his efforts.

While it has always been important for the Station to work closely with practical farmers, the present situation makes such cooperation still more important. It is hoped that farmers will read this report with care and will make suggestions on how we can get the maximum values from the work. It is only through such united effort that we shall eventually "win the war and write the peace" with food.

## ECONOMICS ON THE FARM

### FARM ORGANIZATION AND MANAGEMENT

**Potatoes in Garrett County.**—Potatoes are the main cash crop in Garrett County. In this mountainous area, no particular varieties were grown prior to about 1929. Disease conditions in recent years have made production of potatoes hazardous. However, much improvement has been made by the introduction of new varieties. The leading variety has been the Smooth Rural, but the acreage of varieties more resistant to disease, such as Sequoia and Katahdin, is increasing.

A survey of representative farms was made to determine the status of the potato enterprise. The farms surveyed averaged 184 acres in size, with 64 acres in crops. Gross receipts averaged $2,528 for the two-year period, 1937 and 1938, and expenses were $1,571 per farm, leaving a farm income of $957.

There was an average of 5 acres of potatoes per farm, and an average production of 208 bushels per acre. Cost of production was 44 cents per bushel, and the selling price was 79 cents, leaving an average return of 35 cents per bushel. All farmers did not make this favorable return as profit depended on yield and yields varied from 83 to 507 bushels per acre.

Prevalence of disease was the main factor that affected yields. Farmers with the lowest incomes made about 3 applications of spray or dust and had an average yield per acre of 89 bushels, whereas, farmers with the highest incomes made 7 spray applications and harvested an average yield of 250 bushels per acre.

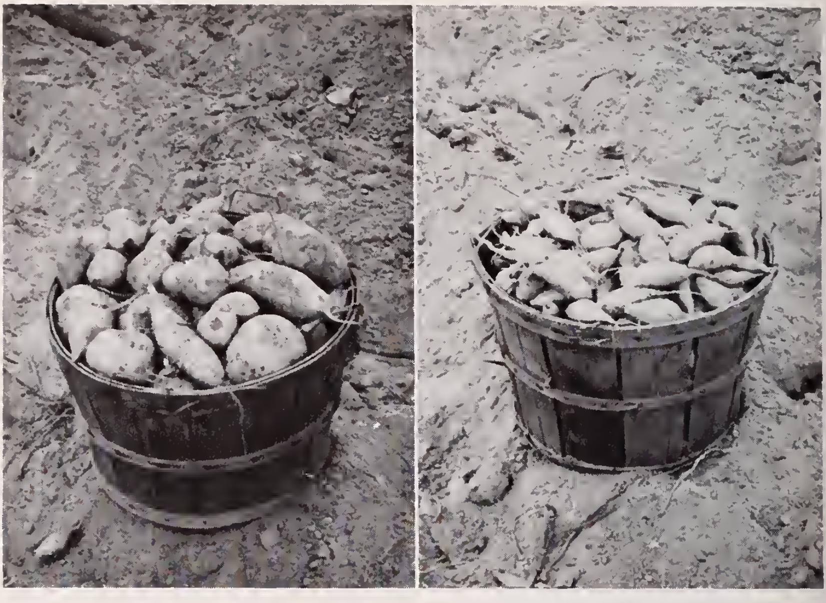
Most of the potatoes are sold at the farm to local dealers and truckers. These buyers say that the main objections to Garrett County potatoes are the prevalence of disease, lack of uniform grading, and failure to use new containers.

**Cost of Raising Dairy Heifers.**—Maryland dairymen are asking what it costs to raise a dairy heifer to maturity. How many heifers are needed annually to maintain the dairy enterprise in Maryland? From what source are these replacements obtained? To answer these questions, records were taken in 1940 on 200 dairy farms selected to represent producers shipping to the Baltimore and Washington markets.

Preliminary results indicate that 69 per cent of the cows were raised on the farms where they were found, and 31 per cent were purchased. These herds averaged 23 cows and produced an average of 23 calves. The calves were used as follows: 24 per cent were kept on the farm for replacements, 7 per cent were sold to other farmers to be raised; and the remainder were sold for veal, or died. Farmers indicated that they preferred to keep annually one heifer for every four cows for replacements. Calves raised were, in most cases, bred to freshen in about 27 months. The total cost of raising a heifer to maturity varied from $50 to $146, and averaged $87.75.

**Producing and Marketing Sweet Potatoes.**—A survey was made to determine the production and marketing practices, costs, and methods for improvement. The data collected relate to the crop year 1938.

The farms studied averaged 87 acres, of which 58 acres were in crops. Sweet potatoes averaged 12 acres per farm and yielded 186 bushels per acre. The Maryland Golden variety was preferred by producers, largely because of the premium paid on most markets. Cost of production averaged 60 cents per bushel and the selling price was 83 cents per bushel, indicating that for the area as a whole the sweet potato enterprise was profitable in 1938. However, some producers failed to make expenses.



Field Grade Number 1 Field Grade Number 2

FIG. 1. *Sweet potatoes are graded at time of harvest into Field Grades, but they must be washed, regraded, and packed in new containers before they are sold on the wholesale market. Better grading practices should be followed by producers.*

The study indicates that farmers have made many adjustments in production to produce sweet potatoes at a low cost, but that marketing methods need revising. Inspection of a load of sweet potatoes several times along the route from the packing shed at Salisbury to consumers in New York City showed that loss from shrinkage and waste was rather small through wholesale channels, but was large in retail stores. Most of the loss in retail stores was from decay due to bruising.

Greater care should be given sweet potatoes during harvesting to prevent bruising and cuts that may later cause decay. Consumers prefer a short, thick sweet potato weighing from 3 to 5 ounces. Producers may well consider this factor in determining when to harvest.

## FARM TAXATION AND FINANCE

**Farm Property Assessments for Taxation.**—A study of about one-third of the farms in Maryland shows the need for a more equitable and uniform method of procedure and basis for determining the classification of land, buildings, and livestock for taxation and the rates of assessment for each class. Land not uniform in character is assessed at rather uniform rates per acre in one county, but at variable rates in another county.

In some counties, the type of road is used largely as the basis for determining the unit rate per acre, and it is quite possible that not enough difference is made in the assessment of similar land located adjacent to different types of roads. The assessing of one class of land, such as woodland, at a uniform rate, while assessing tillable land at variable rates also provides opportunity for inequalities.

Practically all livestock of a given class take the same assessment per head in some counties, while in other counties variable rates are used. This may result in the same average assessment per head for the counties, but there is a considerable difference in the treatment of individual taxpayers.

Results thus far suggest that original assessments would be greatly improved if more attention were given to the qualifications of the personnel, if the assessors were equipped with more aid in the form of sales data, tax maps, etc., and if more time and attention were given to details.

**Residential Property Assessments in Two Counties.**—The assessment of urban real estate in Prince Georges and Montgomery counties was compared, at the request of the Prince Georges County Real Estate Board.

It was found that like properties are assessed somewhat higher in Prince Georges County than in Montgomery County. Also, that properties of lower values are assessed relatively higher than those of higher values. This results in a disproportionate tax burden in the former county, because of the larger proportion of lower value properties.

**Annual Report of Farm Bureau-Grange Joint Tax Committee.**—Data assembled and analyzed in this report show that the average tax rate on farm property in Maryland for 1940-41 was $1.50 per $100 of assessed valuation, compared with $1.40 for the two years previous and the depression low of $1.21 in 1934-35.

An analysis of motor vehicle accidents in Maryland during 1938 and 1939 showed that a large majority of such accidents were caused by driving too fast, or in a reckless manner. Physical defects of the motor vehicles, or the persons involved, were a minor cause of accidents.

The report of this joint committee also presents suggestions regarding tax legislation, property assessment administration, highway finance and motor vehicle regulation.

**Fiscal Capacity of Maryland and Other Selected States.**—Recent developments in Federal taxing policies make it imperative that the State give close attention to its fiscal resources and program. Compared with other states of similar economic pattern, Maryland seems to have comparable and adequate taxable resources. While State tax revenues have increased 50 per cent during the last 10 years, this increase is less than the average of the 12 states compared with Maryland.

A comparison of important tax revenues of the various states shows that collections in Maryland are relatively high for property taxes and gasoline taxes, but comparatively low for motor vehicle license fees, inheritance taxes, and certain aspects of income taxes. Some adjustments in the State taxing program will be necessary from time to time in order to make it harmonize better with the policies of other states and the Federal government. A more scientific and rigid application of the present tax laws of the State should assist in obtaining more revenue without undue injustices to taxpayers.

Several sources of revenue are yet available to the State, if necessity arises and the Federal government has not utilized such sources. Most important of such possibilities are general sales taxes and special commodity taxes, as well as more complete use of income taxation. Property taxes should be left to the local government and eventually be reduced, or even eliminated for State purposes.

**Improving or Surfacing Rural County Roads.**—Unsurfaced roads still serve about 38 per cent of the farm units in the State, and, in some counties, as many as 60 per cent of the farms border unsurfaced highways.

This study is in its early stages. It indicates that the costs of surfacing local farm-to-market roads in recent years has been too high per mile, with the result that many rural areas, no different perhaps from those now well supplied by road facilities, will not be benefited by any kind of road surfacing for many years.

It is the expectation that further facts will assist in formulating a local road program which will be serviceable to the greatest possible number of farmers, and which can be financed equitably.

## INSURANCE AND CREDIT PROBLEMS

**Farmers' Mutual Fire Insurance.**—There are now 16 farmers' mutual fire insurance companies in Maryland, 4 of which are assessment companies and 12 advanced premium companies. The first mutual company was organized in 1843 and is now making preparations to celebrate its 100th year of successful and continuous operation.

Farmers' mutual fire insurance represents one of the oldest and soundest types of agricultural cooperative organization. In 1939, the total net insurance in force held by Maryland mutuals was approximately $272,000,000. Of this amount, about $213,000,000, or 78 per cent, was written on Maryland property, of which about 53 per cent was on farm property. Approximately 72 per cent of the total value of farm buildings is insured with farmers' mutuals.

FIG. 2. *Farmers' mutual fire insurance is one of the oldest and soundest types of agricultural cooperative organization. Fire causes heavy losses to farmers annually. Insurance is a means for protecting against fire losses.*

It is usually possible for mutuals to write fire insurance at a lower rate than old line companies, since they operate on a cost basis. It is necessary for companies to have a sufficient volume of business to maintain economical operation. All members must recognize their mutual obligation and benefit and keep fire losses at a minimum, if they would obtain their insurance at the minimum rate.

**Farm Credit on the Lower Eastern Shore.**—Farm expenses are usually spread over a long period, from planting a crop to harvesting, and income is often confined to a short period, the marketing period. Consequently, many farmers find difficulty in having money available when needed. Furthermore, farming is generally a season in arrears as far as financing is concerned, as many farmers do not carry over sufficient money from one season to pay all expenses of the succeeding season.

Some type of financing for agriculture appears necessary and short-term credit of various kinds has played an increasingly important role in recent years. The fact cannot be overlooked that farmers in many instances are paying exorbitant interest rates.

The Federal government has been instrumental in establishing credit agencies whereby the interest rate on borrowed capital necessary for operating the farm will be maintained at a reasonable level.

The cash crop type of farming in the Eastern Shore area encourages the use of excessive credit because of large expenditures for fertilizer, which is used extensively in production of truck crops, and for feed used primarily in the large broiler industry. About 70 per cent of the short-term credit used was in the form of merchant credit; cash loans accounted for about 20 per cent; installment credit, 6 per cent; and open account credit, about 4 per cent of the total. The interest charge on merchant credit averaged 18.6 per cent and on cash loans it was 5.6 per cent.

Such extensive use of merchant credit has resulted in farmers paying large sums of money for interest and carrying charges, thereby reducing farm profits. They would find it profitable to shop for credit, the same as for any other commodity, and take advantage of the possible saving by financing farm operations with cash loans.

## MARKETING AGRICULTURAL COMMODITIES

**Marketing Cooperatively.**—Farmers in Maryland have been marketing their products, purchasing supplies, or performing other services cooperatively for the last 35 to 40 years. The cooperative business in this State for the 10-year period, 1930-39, averaged $16,530,000 annually. Marketing cooperatives accounted for 84 per cent of this volume of business; purchasing cooperatives, for 15 per cent; and service cooperatives, for less than 1 per cent. Milk was the most important commodity, with tobacco second, and canning crops third.

Sound business principles are just as essential to the success of a cooperative as any other business. The most commonly used measures, or yardsticks, for analyzing the financial status of farmers' cooperatives are: the ratio of current assets to liabilities, a 2 to 1 ratio being considered desirable; members' equity, which is the total net worth in relation to total assets, a ratio of 60 cents of net worth to every dollar of total assets being considered desirable; reserve policy, which is based on the relationship of surplus and reserve to the total amount of business done; and, operating efficiency, which measures the relationship of operation expenses to total business.

A cooperative can be no stronger than its members, whose loyalty and patronage are necessary. Farmers can do many things cooperatively which are impossible individually.

**Community Auctions.**—The idea of a free, competitive market appeals to many farmers. In the auction ring, or on the auction floor, a farmer's product is displayed and the buyer bids on it according to its merit. By virtue of this public display, the exhibit of price based on quality, the farmer is educated in values.

During 1939, approximately $4,500,000 worth of farm products was marketed through community auctions in Maryland. The volume of business of auctions has increased considerably since that time, particularly with tobacco. Livestock, fresh produce, eggs and poultry and tobacco are sold by auction in various parts of the State.

All of the auctions operated in Maryland are privately owned partnerships or corporations, with the exception of the poultry and egg auction and three of the produce auctions. There is a commission charged for sale of all products, which is generally considered reasonable.

Farmers who are not satisfied with the prices they are receiving under present marketing methods may well investigate community auctions.

**Storage Facilities and Consumption of Local Farm Products.**—With the defense program competing with other commodities for transportation facilities, the extent to which local communities can "live-at-home" takes special significance.

A study of the production and consumption of locally grown farm products in the Frederick and Salisbury areas shows that both of these towns and their surrounding production areas could become almost self-sufficient in an emergency. To meet an emergency of this type, consumers would have to change their diet somewhat and farmers would have to change their production and marketing programs to some extent.

Frederick County produces a surplus of nearly all types of food products, such as meats, poultry, eggs, dairy products, fruits and vegetables. Certain foods in each group can be produced locally, but are imported from other areas. These include butter, cheese, cabbage, cauliflower, celery, carrots, onions and lettuce. Some other foods are produced locally during the season and imported at other times. Adequate storage facilities and refrigerator lockers would provide for increased local consumption of the seasonal products.

Wicomico County produces an enormous surplus of fresh vegetables during the local season, but has a deficit in several types of food. More than 80 per cent of the meats, exclusive of poultry, are imported from distant areas. Although all of the milk consumed in this county is produced locally, the per capita consumption of milk is about one-half that of Frederick County. Production of meat animals and dairy products for local consumption in Wicomico County should be increased. Storage facilities and refrigerator lockers would help to increase the local consumption of seasonal vegetable crops.

**Relationship of Quality to Retail Price of Canned Vegetables.**—When the consumer buys fresh vegetables, she can see what she is buying, but with canned goods there is no way to determine the quality of food in the can except as it is indicated by the label.

Samples of canned corn, tomatoes, and peas packed in Maryland and in other states were purchased in Baltimore and several towns, and later they were graded by the U. S. Department of Agriculture to determine their quality.

The results indicate that there is very little relation between quality and retail price of canned vegetables. It was found also, that the label on the can did not truly represent the quality of the contents. Analysis of different cans of any one vegetable packed under the same brand name showed that there was little uniformity in the quality. There were a few brands that remained fairly uniform from one can to another, but, in general, it was impossible to determine the quality of a particular brand by examining one can.

If canned vegetables are to be sold on a quality basis, it will be necessary for canners to pack products more uniform in quality and some method of grade labeling will have to be established.

## LAND ECONOMICS

**Fruit and Vegetable Production on the Lower Eastern Shore.**—Strong competition from truck crop producers in the Southern states has affected adversely the economic position of farmers in the lower Eastern Shore area. The situation could easily develop into a cycle in which farmers continue to exploit their resources in an effort to produce a sufficient cash income.

Studies were made in six areas to determine the particular problems confronting each area and adjustments that appear desirable.

These studies indicate that farmers in these areas would benefit by greater use of cover crops and other soil improvement practices, including wider use of crop rotation and less double cropping. Also, that many farmers could profitably increase their livestock production, both for family use and for market.

Efficient marketing practices must follow economical production of cash crops, most of which are quite perishable. Improved grading and standardization of truck crops is needed, if growers are to compete successfully with producers in other states.

**Classification of Agricultural Areas.**—Necessity for distinguishing between agricultural areas has become more and more apparent in recent years with the increased attention that has been devoted to development and application of farm programs.

A classification of the agricultural land in Frederick County was completed in the spring of 1941. The main objective was to develop a method of land classification which could be used efficiently and expediently under the wide range of conditions that characterize Maryland agriculture.

The results of this study were unique in that it was found that economic and social factors, as well as physical factors, are essential in the proper classification of land. Factors that were found most useful in classifying Maryland agricultural land are: Climatic data; topography and erosion; soil characteristics; soil productivity ratings; types of farm land use; agricultural production; gross farm income; size and condition of buildings; and, social conditions.

The agricultural land in Frederick County was divided into six classes, with Class I land being the best and Class VI land being the poorest in the county. The percentage of land in each class is as follows: Class I, 6.3 per cent; Class II, 15.9 per cent; Class III, 32.3 per cent; Class IV, 29.3 per cent; Class V, 2.5 per cent; and, Class VI, 13.7 per cent.

## The Distilling Industry in Maryland

A survey of certain economic facts pertaining to the distilling industry, particularly as they relate to agriculture, was made at the request of the Association of Maryland Distillers and Allied Industries.

This industry had a captal investment of about $39,000,000 in 1940, paid about $2,000,000 yearly in wages, and spent more than $8,000,000 for materials and production.

About 147,000,000 pounds of grains were used in distilleries of the State in 1940. Corn represented 42 per cent, and rye 45 per cent of the grains used. The amount of rye used was equivalent to four times the production by Maryland farmers.

Distillers paid taxes, or assumed obligations for tax payments (mostly excise taxes) which are recoverable, to the amount of nearly $30,000,000 in 1940. Federal excise taxes represented 87 per cent of these tax obligations. The proportion of state revenues collected from alcoholic beverages in Maryland was somewhat higher than in Delaware, Massachusetts, and New Jersey. Per capita State and local revenue from alcoholic beverages was higher than the average of seven states similar to Maryland in economic characteristics.

## FARM MACHINERY AND EQUIPMENT

**A Small Electric Milk Pasteurizer.**—Pasteurization of milk by the small producer-distributor may soon become not only possible but practical if an electric pasteurizer developed jointly by Agricultural Engineering and Dairy Manufacturing can be brought into commercial production. The present model, of 12 gallons capacity, can be used on any alternating current service large enough to operate a 5 h. p. electric motor.

The pasteurizer is of the batch type using the standard holding method of heating to 143.5° F., and holding at that temperature for 30 minutes. It is as effective as the modern hot water pasteurizer with which it was compared. Cost of operation ranges from 0.3 to 0.7 cents per gallon with electric current at 2 cents per kilowatt-hour, depending on the initial temperature of the milk. Operation is practically automatic. All that is required is to set the clock and turn on the current when the pasteurizer is filled and to shut it off and cool the milk when the bell rings at the end of the 30-minute holding period.

It is hoped that this unit can be brought into commercial production as soon as materials for other than defense needs again become available. In the meantime, the work will continue to bring the construction within the limits of the ordinance recommended by the United States Public Health Service.

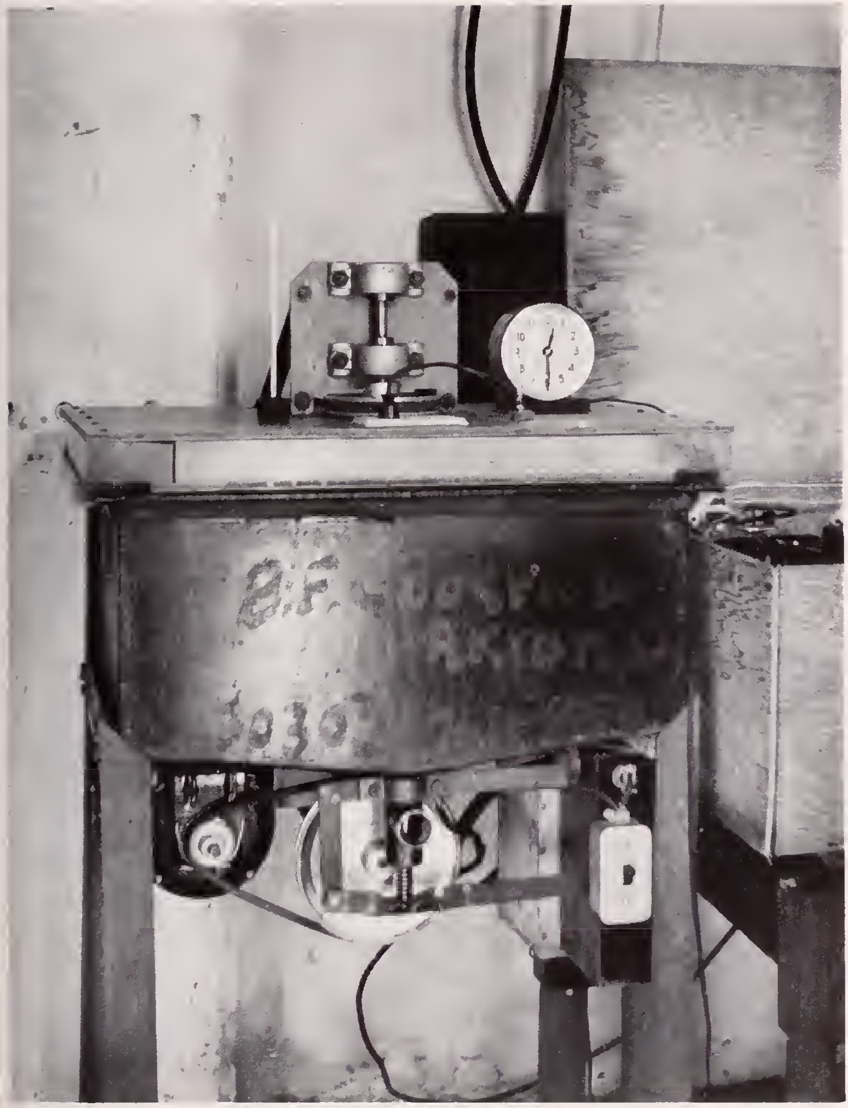


FIG. 3. *Present model of Milk Pasteurizer in operation.*

**Egg Coolers and Cooling Conditions.**—Keeping a fresh egg fresh is a difficult job in Maryland on a hot, summer day. Two conditions are necessary, high humidity to keep the egg from drying out and low temperature to keep the egg from incubating or otherwise spoiling. The latter of these is hard to get on a hot, summer day when the thermometer nears the 100° mark. Underground storages help a lot, especially in keeping up the humidity and in keeping the temperature uniform. This may be the best the man with the small flock can do. Be careful about molds, for a musty egg is about as worthless as a rotten one. Painting all wood with a 10% zinc chloride solution will help to keep the molds out and keep the cellar smelling fresh.

For the larger producer, we hope to have a practical electric unit by next year. It looks good so far.

**Grain Storage on the Farm.**—Unfavorable weather during the harvest period in Maryland frequently makes it difficult to harvest grain when it is dry enough for safe storage. Much grain, especially that used for feed on the farm or by a local mill, should be stored on the farm. Drying grain on the farm makes possible the safe storage of grain harvested during periods of bad weather. The department's recently developed portable grain drier has been used effectively for drying wheat and barley harvested by combine during rainy weather.

During the past year, shelled corn has been dried in this drier. Drying corn is somewhat slower than drying wheat or barley, as corn has larger kernels and the initial moisture content is usually higher. Safe bulk storage of shelled corn requires thorough drying.

## FARM CROPS, SOIL, AND SEED INSPECTION

**Sweet Corn Seed Production and Breeding.**—So many new hybrid sweet corns have come onto the market in recent years that canners and market gardeners cannot judge which are best adapted to Maryland conditions and which show most desirable table qualities. During the past year 98 strains were tested for yield and quality, many of them at two places in the state.

An effort was made also to produce strains of corn superior, for Maryland conditions, to any on the market. One noteworthy inbred strain has been developed and made available to commercial seedsmen. In eight comparisons extending over a period of three years, crosses with this strain have given an average yield 17 per cent above the best commercial white strains or hybrids available for use in the state.

**Development of Dent Corn Hybrids.**—The acreage of different strains of hybrid field corn is increasing so rapidly that within two years the majority of the corn acreage in Maryland is likely to be planted to hybrids. With this rapid expansion a large acreage is planted to unadapted seed. To provide information on local adaptation of the various hybrids which may be planted, yield and growth comparisons are conducted at College Park and at other places in the state.

Some of the hybrids on the market are distinctly superior to the local corn varieties in both yield and resistance to storm damage. However, during the period of test, more than half of the hybrids tested have been inferior to the local varieties. Therefore, such tests must be continued if the corns to be grown are selected intelligently. Up to the present time, no full-season hybrid has been found that is consistently superior to U. S. 13.

A second feature of the work under this project is the development of new inbred strains and new combinations in an attempt to obtain hybrids superior, under conditions here, to those now on the market. This latter work has not progressed far enough for any new hybrids to be recommended. However, the progress to date is encouraging.

**Stalk Rot Resistant Dent Corn.**—Selection of disease-resistant inbred strains of corn for use in later crosses is the purpose of this work. It has not progressed far enough to produce practical results. However, results to date show much promise.

**Sugar in Relation to the Starch Factor in Corn.**—Is sweet corn capable of producing plants as vigorous as those of field corn? If it is, much progress needs to be made by sweet corn breeders in this part of the United States for none of the sweet varieties now on the market approach field varieties in size and vigor. The results of this study indicate that it should be possible to obtain sweet corns showing about 90 per cent of the size and yield of field corns.

To what extent can a peculiarly desirable characteristic of one corn variety be induced to separate from the remaining characteristics of that variety and to combine with those of another variety? The results of this study indicate that even after many generations of recombination any characteristic of one variety is still likely to segregate in association with many other characteristics of the same variety. Therefore, a desired recombination can be brought about only with very great difficulty, if it can be accomplished at all.

Various theories have been presented by geneticists to account for the hybrid vigor which is utilized to such a great extent in present corn breeding practice. Increased knowledge of its nature should permit greater utilization of such vigor. This study throws some light on its nature by demonstrating that its components may be discovered in the segregating members of any generation after the initial cross.

Among other results are the calculation that the amount of self-fertilization which occurred naturally in the corn under study varied in amount from none to about 10 per cent in different seasons with an average of about 4½ per cent.

Plants produced from large kernels were more vigorous than those produced from medium or small kernels even though the latter kernels were sound and well developed.

**Wheat—Hybridization and Selection.**—The object of this work was to develop and demonstrate the superior qualities of new sorts of wheat for use in Maryland. Leapland, a selection made by the Maryland Station continued to give a good account of itself. In productivity and loose smut resistance it maintained its relatively high standing.

In the nursery, steps were taken to isolate new lines from a hybrid population which has been carried for a period of 12 years, with the hope that a strain may be found which is superior to existing varieties, especially in disease resistance.

**Barley—Hybridization for Smooth Awns.**—The object is to breed and establish strains of smooth-awn winter barley for Maryland. At present the work consists in conducting comparative field tests, together with a back-crossing program designed to increase the winter-hardiness and smut resistance of existing smooth-awn varieties. During the year 1939-40, the field work was conducted on heavy land that has a tendency to remain soggy through late winter and early spring, a condition not conducive to the best barley response. Due to excessive heaving, the crop came through the winter in a weakened condition. Final yields were very low, ranging from 14.5 to 20.4 bushels per acre. Under these conditions the smooth-awn sorts, such as Marnobarb, were at a disadvantage. They had poorer stands and finally made poorer yields than the older, rough-awn variety, Tennessee Winter.

The tests also indicate that brown loose smut becomes very serious if allowed to build up from year to year in seed stocks of smooth-awn strains. It is necessary, therefore, to multiply commercial seed supplies from hot-water treated foundation stocks. The latter treatment has proved very effective at this Station in reducing the percentage of loose smut. All foundation seed of Marnobarb now being released is grown from treated seed.

**Improvement, Production and Use of Rye in Maryland.**—The rye now grown in Maryland is not as good for distilling purposes as that used by distillers. Because of this, steps have been taken to study the effect of soil type and soil fertility treatments on yield and kernel quality, to determine by field tests what varieties of rye are adapted to Maryland conditions and are capable of competing with wheat in present cropping systems, and to initiate a breeding program for the purpose of improving rye with respect to productivity, starch content, and other kernel characteristics.

As a preliminary step, Abruzzi rye seeded on infertile, gravelly loam soil of the Sassafras series was top-dressed in the early spring with fertilizers varying in nitrogen, phosphorus, and potash content. All treatments gave increases in yield, the largest increase (7.2 bu. per acre) being made by nitrate of soda at the rate of 150 pounds per acre. However, grain from this plot had the lowest average kernel weight. Kernel starch content was intermediate. The high phosphorus plot produced the heaviest kernels, while the complete fertilizer (2-12-6) and the potash plots produced kernels with the highest starch content. In this respect, grain from these two treatments compared favorably with northern-grown Rosen, the type commonly used by distillers.

Twenty-five samples of rye collected from widely distributed Maryland farms ranged from 60.0 to 64.6 per cent starch as compared to 65.1 per cent for northern-grown Rosen. The majority of samples, however, fell below 63 per cent starch.

Eight varieties of rye were grown on four fertility levels at four different locations in 1941. Although results are not yet available, they should shed light on the question of varietal response under different soil and fertility conditions.

**Hay, Forage and Pasture.**—The major part of the work now active includes tests of different strains of clover and alfalfa. In all, 18 strains of red clover and 56 strains of alfalfa are under observation.

**Annual Legumes—Soybeans.**—Among soybeans for hay none have been found that are superior to the Wilson strains and Virginia. Among varieties for seed, particularly for oil extraction, Manchu has led the tests for several years. Other promising varieties for this purpose include Harbinsoy, Illini, Mandel and Dunfield.

**Improvement of Permanent Pastures.**—The transition zone between southern and northern grass-land agriculture extends through Maryland. Therefore, the problems of pasture management here are peculiarly diverse.

Work is under way in breeding and selection for improved strains of pasture plants and upon problems of fertilization and management. Orchard grass breeding has been conducted in conjunction with the Regional Pasture Research Laboratory at State College, Pennsylvania, and with the Federal Forage Crops Office. Limited seed lots of several new strains are now ready for test.

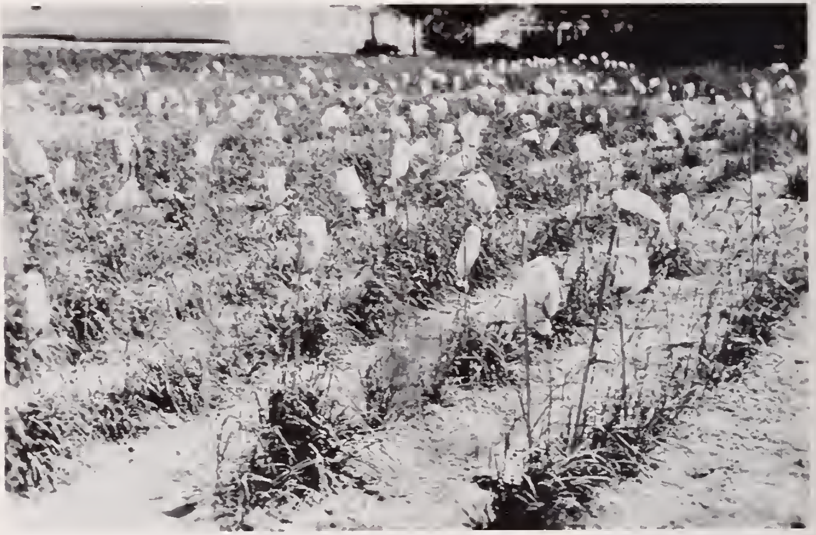


FIG. 4. *Orchard grass nursery. The Maryland Station is active in the search for superior strains of pasture and hay plants.*

A number of white clover seed lots from the market have given disappointing results when compared with native strains. A little seed of some of the local material is now ready for distribution. Breeding and selection of local perennial rye grasses and creeping red fescues are in progress.

Fertilizer test plots have been laid out on new pasture land at the Plant Research Farm. Production from various grass and legume combinations are under study in an adjacent area.

Yield records under cages in various parts of the state indicate that on most soils judicious fertilization and management in a typical season result in production of more than two and one-half tons hay equivalent per acre on permanent pastures where production on untreated pastures rarely exceeds half of that amount.

**Flowering and Seed Production in Certain Pasture Plants.**—Some of the most desirable selections of pasture plants spread and cover the ground with an even turf because of their tendency to send out underground shoots or rhizomes. With a number of species, plants which behave in this way produce very little seed. Therefore, it is difficult to produce seed cheaply enough to put it on the commercial market.

This study is a technical one designed to give information that can be used to induce more abundant seed production from some of these strains of pasture plants.

Observations indicate that many of these plants will seed abundantly, if they are maintained in cultivated rows and are not permitted to form a solid turf.

**Effects of Different Short Rotations.**—Recent soil conservation activities have reduced the concentration of agricultural production on erodible lands and have increased concentration on some of the non-erodible lands. Also, the introduction of combines has made certain short rotations economical that were not possible before.

An attempt is being made to answer many of the questions that are now being asked concerning the degree of success that can be expected from various short rotations, either for intensive production of silage and other livestock feed or for cereal and legume seed crops when all straw and residues remain on the land.

The study has been in progress for only one year. Therefore, answers to the questions have not yet been obtained.

**Fertilizer for Late White Potatoes.**—This work is conducted in Garrett County. Results to date indicate that the most profitable fertilizer ratios conform very closely to that in the 4-8-8 fertilizer which is now recommended for late potatoes. The results indicate further that when such a fertilizer is applied at the rate of 1,000 pounds per acre, the average yield per acre is about 30 per cent above the average yield for the region where these plots are situated.

**Soil Fertility at the Hopkins Farm.**—On the new Plant Research Farm a series of fertility plots was laid out and several years of preliminary crops were grown to test the uniformity of the soil. The plot series includes three ranges on which a three-year rotation of corn, small grain, and mixed hay is maintained. On each range three lime levels are established at pH of approximately 5.5, 6.0, and 6.5. Across these ranges different amounts of the different fertilizer constituents are applied, both alone and in combinations. No tentative results can be presented until one year hence, when the first rotation is completed.

**Factors Affecting Available Potassium in Maryland Soils.**—The purpose is to work out a procedure or method suitable for rapid soil testing that will help indicate with reasonable accuracy the potassium needs of Maryland soils. Plots were laid out on 13 farms in different parts of the state.

Results to date show the need of improvement in the quick testing methods now in use.

**Holding Plant Food Materials in the Soil.**—Many Maryland soils, particularly in the tidewater section, are not capable of holding large quantities of plant food materials available at all times to the growing plants. However, the deficiency in mineral constituents responsible for this condition may be overcome by the maintenance of large quantities of organic matter in an effective stage of decay. Organic matter from all plants does not function equally in this respect because both the rate of decay and the nature of the residual product varies.

An area on the Station farm has been tested for uniformity of soil and of crop growth by uniform cropping started in 1939. This area has been laid off in plots where green manuring crops that differ widely in their nature will be compared as to their effectiveness in causing accumulation of organic matter in form most effective for holding available plant food materials.

Along with this field study a laboratory study is in progress to distinguish between the organic colloids produced from decaying plants and the mineral colloids which are responsible for these soil reactions.

**Efficiency of Soil Fertility Management.**—The Agricultural Experiment Station makes recommendations on fertilization and treatment of different soils in the State. These recommendations are based upon results of soil fertility and management studies that have been carried out either here or elsewhere.

About ten years ago, work was started to learn the extent to which these recommendations are adequate for maintaining or increasing soil fertility and crop production on important soils in Maryland. Fertility practices and crop yields on more than 30 farms were recorded and analyses were made of soils in the different fields. Each year since that time all lime and fertilizer applications have been recorded and the accompanying yields have been determined. Continued soil analyses show whether there is an accumulation or a loss of lime, phosphorus, potassium or other chemical materials, as well as organic matter.

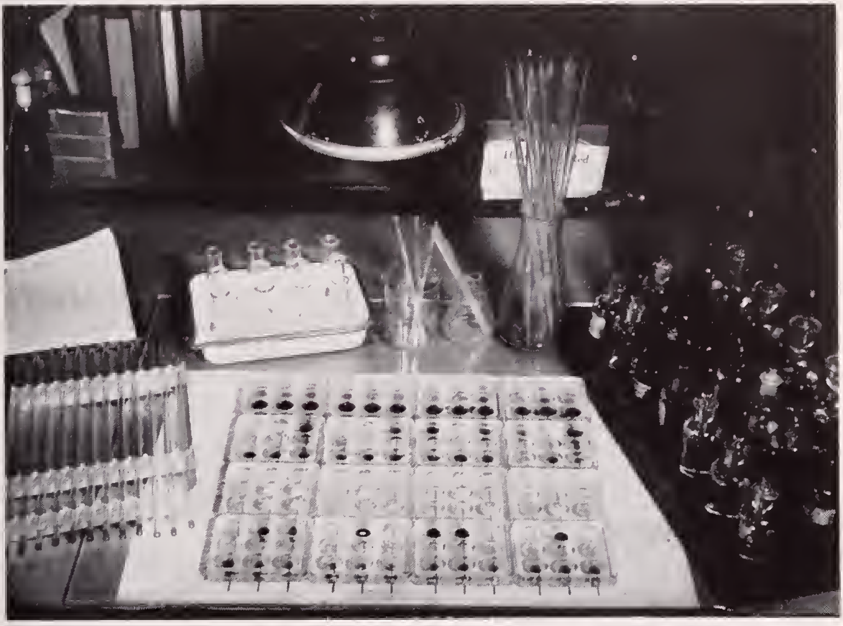


FIG. 5. *Soil testing equipment. Extensive use of the "quick test" as an aid in diagnosing soil deficiencies is responsible for research designed to improve current methods.*

Results to date indicate that during the years since the beginning of this study the farmers have increased the rates of application of commercial plant food by about 25 per cent. This increase has been accompanied by an increase in plant production of from 10 to 20 per cent for the entire rotation. The practice of applying fertilizer for corn has expanded rapidly and has produced profitable results. The exchangeable calcium, magnesium, and potassium in the soil have been either maintained or increased. However, the amount of available manganese has tended to decrease gradually during the period of study.

**Soil Moisture Conservation, Soil Fertility and Flood Control.**—This work was started in 1940 in cooperation with the Soil Conservation Service to determine the effect of strip cropping and terracing on the water content of the top 14 inches of soil under a three-year rotation of corn, small grain and hay and has been expanded to include pasture and woodland.

The first year was designed to learn the nature of the difficulties which must be overcome in taking readings and assembling detailed records. During the year various simplified procedures were adopted for use in later detailed records.

**Tobacco Investigations** (*In cooperation with the U. S. D. A. Bureau of Plant Industry*).—Studies on tobacco production have been in progress for many years at the Tobacco Substation at Upper Marlboro, where work is conducted in cooperation with the Office of Tobacco Investigations in the United States Department of Agriculture.

Because the crop of any one year is usually marketed in the late summer of the next year, any reports of progress are one year late.

*Breeding Program:* Objectives in the breeding program are improvement in both yield and quality of leaf. In this program the essential characteristics of Maryland tobacco must be retained.

Results to date include the selection or development of strains that are very low in nicotine; strains that are resistant to mosaic, others that are resistant to root rot, and one that is very resistant to fusarium wilt. This last strain is now distributed widely through Southern Maryland.

*Variety Tests:* Two sets of variety tests are conducted. In one set, a two-year rotation of tobacco and weeds is intended to keep the land free from root rot. In the other set, tobacco is grown each year on the same land, liberal applications of horse-stable manure are used, and the land is inoculated to encourage development of black root rot.

Comparative yields vary with the amount of disease present. Two varieties showing strong resistance to root rot are Stand-up Root-Rot Resistant, and Catterton's Root-Rot Resistant. Two varieties showing strong resistance to fusarium wilt are Robinson's Medium Broadleaf and Rawlings Fusarium Resistant.

*Cropping Tests:* Cropping tests include a study of the effect of different leguminous and non-leguminous weeds on yield and quality of tobacco; the effect of different cultivated legumes when followed immediately by tobacco in comparison with the effect of these same legumes when a weed crop followed the legumes and is plowed under for tobacco; and, the effect of continuous tobacco in comparison with tobacco every second or third year following weeds. This last test includes also the effect of eliminating either nitrogen or phosphorus or potassium from the fertilizer application.

Also, in this group is a series of rotations in all of which 750 pounds per acre of 4-8-12 fertilizer is applied at planting time and in some an additional side-dressing of 550 pounds per acre of potassium sulphate is applied 30 days after planting.

While weed mixtures grow vigorously after tobacco, it is very difficult to induce any one weed in pure stand to grow every other year on the same land. Therefore, because of poor weed growth, the comparative effects of different weeds are less striking in later years than in earlier years on any one piece of land. However, as an average, ragweed and horse weed continue to be most beneficial and lamb's-quarters most detrimental among non-leguminous weeds, while lespedeza is most detrimental among the wild legumes.

In both yield per acre and price per pound, tobacco once in three years followed by a legume and then by weeds is superior to tobacco once in two years followed by a legume and then by weeds. This latter treatment is superior to tobacco each year with legumes plowed under for each crop. In both yield per acre and quality of the crop, hairy vetch appears to be the most satisfactory legume as an average for all treatments.

When no legume is used, tobacco followed by two years of weeds is superior to tobacco followed by one year of weeds and the latter is superior to continuous tobacco. An application of 750 pounds per acre of a 4-8-12 fertilizer gives better results than any application lacking either nitrogen, phosphorus or potassium.

In the rotation tests, none appears to be superior to one year of tobacco followed by two years of weeds. Red clover appears to be superior to lespedeza. In every case where it has been used, a side dressing of sulphate of potash 30 days after plant setting has increased both the yield and the price per pound of the crop. The average yield increase for six years has been more than 100 pounds per acre and the average price increase has been nearly four cents per pound. However, no side-dressing was used in the tobacco-weed rotations.

*Fertilizer Tests:* The fertlizer series now in operation include one established in 1927 and one in 1939 to study the effect of different sources of potash and different rates of application. With the latter series are two sets of plots to distinguish any effect of sulphur in bringing about the marked benefit from applications of potassium sulphate.

Expansion of the building program on the fair grounds has caused the loss of some plots from the 1927 series. However, the remaining plots continue to show the benefits to be derived from heavy applications of potassium sulphate. Tentative results from the series established in 1939 show that increasing amounts of potassium tend to improve the burn of tobacco, but increasing applications of sulphur tend to reduce the burning qualities. However, it is difficult to maintain a low pH in the soil where potassium carbonate is applied.

Another series of plots is designed to test the effect of fertilizer placement. In general, the best results appear to follow placements in which the fertilizer is applied slightly to the sides and slightly below the crown roots of the plant as set.

In still another plot series on soil very low in essential minerals, plots are maintained in which one or another of the plant food elements is so deficient that the deficiency symptoms may be recognized and described.

*Field Moisture Studies:* For a long time it has been observed that the thinness and quality of the cured leaf depend in part upon the time and quantity of rainfall during the growing season. A series of irrigation plots was begun in 1934, in which canvas covers could be extended to protect the plants from rain so that the time and amount of water additions would be under control.

On these plots the highest quality of leaf has been produced where sufficient water is available to the plants at all times. The second best quality under controlled moisture has been produced where the plants lacked water only in late stages of growth and ripening. Quality has been very low wherever the plants suffered for moisture during the early stages of growth, even though abundant moisture might be supplied later.

**Inspection of Seeds Sold Throughout the State.**—Agricultural seeds "sold, offered or exposed for sale" under the provisions of the State seed law are inspected to see whether they are tagged as required. Inspections are made throughout the year, an effort being made to inspect the seed stocks of each retail dealer. Many dealers are visited several times during the year. Agricultural seeds in transit are also inspected. In making these inspections, approximately 500 samples are taken for laboratory study. Without these inspections the State seed law would be of little, if any, value to those who buy agricultural seeds.

**Examinations of Samples from Seeds Sold Throughout the State.**—Our State seed law does not set "standards" but is a "labeling" law, requiring that certain information be furnished with agricultural seeds sold for seeding purposes in the State. The purpose of this work is to check the accuracy of the tagging by dealers whose seeds are sold in the State. Since 1917 the completeness and accuracy of the tagging of dealers selling seeds in Maryland has been published annually. These summaries are based on the determinations made under this project. Under a labeling law, such as we have had in Maryland for many years, the reliability of the tagging of the wholesale dealer is of the utmost importance to the farmer who wants the protection of the State seed law.

**Examinations of Samples Submitted to the Laboratory.**—The object of the work is to give the seed user whatever information he may need for judging the suitability of a lot of seed for the purpose for which it is wanted. In so far as facilities permit, complete information regarding the characteristics which affect the planting value of a lot of seed is furnished under this project. During the calendar year 1940, 690 persons (587 farmers, 74 retail dealers, 9 wholesale dealers, and 20 others) submitted 3,128 samples to the Laboratory for examination. Farmers submitted 965 samples, retail dealers 562, wholesale dealers 1,282, and others 319. Measured in units of work, a total of 5,890 were done during the year; 2,124 for farmers, 827 for retail dealers, 2,527 for wholesale dealers, and 412 for others. There were 111 different kinds of seeds submitted to the Laboratory for examination; 64 kinds of agricultural seeds, 1 kind of tree seed, and 46 kinds of vegetable seeds.

## BEEF, CATTLE, SHEEP, HOGS AND HORSES

**Distillers' Rye Dried Grains as Part of the Ration for Pregnant Ewes.**—In the two years' experiments conducted to date, distillers' rye dried grains have not proved satisfactory in the wintering rations of pregnant ewes. It is believed that the rations containing distillers' rye dried grains are nutritionally incomplete and that part of the trouble experienced may be due, either partially or entirely, to a lack of one or more essential dietary elements.

Three lots of ewes were fed each of the two years. Each lot consisted of 14 ewes the first year and 17 ewes in the second year's trial.

A check ration consisting of shelled corn, cottonseed meal, corn silage, and clover-light timothy hay was fed to Lot 1. Lot 2 received the same amount of silage and hay as the check lot, but no corn was included in the ration until after parturition, when a combination of corn and distillers' rye dried grains was fed. Lot 3 was fed a greater allowance of distillers' rye dried grains than Lot 2, but was fed correspondingly less hay, silage being fed at the same rate as to the check lot. Following parturition, shelled corn was fed at the same rate as to Lot 2. In all lots the contents of total digestible nutrients and the nutritive ratio were practically identical.

Results were obtained that measured the effect of ration on weight, condition and vigor of ewes; effect of ration on fleece, weight and length of fiber; and effect of ration on birth weight, vigor and subsequent development of the lambs.

The ewes in Lot 1 maintained their weight more satisfactorily and showed greater vigor and condition following parturition than did the ewes in Lots 2 and 3. The ewes in Lot 3 lost more weight and had less vigor following parturition than the ewes in Lots 1 and 2. This was especially true in the second year's experiment.

The average fleece weight, on both the grease and scoured basis was in favor of Lot 1. There was no significant difference in length of fiber between Lots 1 and 2. Lot 3 showed the shortest fiber and on the scoured basis produced the lightest average fleece during the first year's experiment. Fleece data are not yet available for the second year.

Lot 1 showed definite advantage over Lots 2 and 3 in per cent of lambs born, lambs raised, birth weight of lambs, and average daily gain per lamb. The lambs in Lot 2 had a higher average birth weight and made a higher average daily gain than those in Lot 3.

A nervous disorder was noted in Lots 2 and 3. This was evidenced by a twitching of the hind legs and thighs and a lowering and shaking of the head.

**Barley Compared with Corn, and Corn Silage with Alfalfa Hay in Fattening Rations for Steer Calves.**—In order to measure the relative net energy values of these feeds, four lots of steer calves, 10 head in each lot, are included in this experiment.

The check lot receives a ration of corn, soybean oil meal, silage and alfalfa. The second lot receives the same total grain ration as the check lot, and the roughage portion of the ration consists entirely of alfalfa hay. A third lot receives the same total grain ration as the check lot, but is fed only a limited amount of alfalfa hay plus all the corn silage that can be consumed readily. The fourth lot receives a ration differing from the check lot only in that crushed barley is fed instead of shelled corn and at a slightly higher level to compensate for the difference in content of total digestible nutrients in these grains. The nutritive ratios of the rations fed are practically identical, the amount of soybean oil meal having been adjusted in each of the three test lots so as to provide a ration similar to the check ration in this respect.

**Energy Values of Distillers' By-Products in Rations of Beef Steers.**—Distillers' rye dried grains, when fed to replace a portion of the corn in the grain ration of fattening yearling steers, had an energy value of three-fourths (approximately) that of shelled corn. The value of this feed, however, was increased when small amounts of cane molasses were added to the ration. A combination grain ration consisting of corn, distillers' rye dried grains, and cane molasses produced the greatest amount of finish in each of two trials.

Substitution of distillers' rye whole slop for some of the corn in the grain ration resulted in a marked decrease in the finish of the steers in each trial. This was reflected in a lower valuation placed on these steers. Results of this experiment seem to indicate that this feed has a relatively low value in the fattening rations of the better grades of beef cattle.

Two separate trials were conducted in this experiment, one from December 9, 1938 to May 4, 1939, and one from October 7, 1939 to April 16, 1940. Forty head of yearling steers were fed in each trial. Reasonably uniform results were obtained in the two trials and this experiment is now completed. Final results will be available in the near future.

FIG. 6. *Steers used in calf feeding tests.*

The experimental technique followed in this project was different from that used in ordinary feeding experiments. Gains made by the animals in the experimental lots were controlled by varying the amounts of the test feed. Thus, each experimental lot was made to produce approximately the same gain as was made by the lot receiving the check, or standard, ration. Carcass analyses on one-half of the steers in each lot were made. These provided a means of measuring differences produced by the various experimental test feeds. By determining the amount of the test feed required to produce the same gain as a known amount of the standard feed, and by measuring the differences in finish produced, it is believed that quite definite and accurate values may be ascribed to the test feeds.

**Swine Breeding Investigations.**—This experiment, conducted cooperatively by this Station and the Bureau of Animal Industry, U. S. Department of Agriculture, was started late in the fall of 1940. Ten purebred, registered Berkshire sows were double mated to a Danish Landrace and Berkshire boar to farrow late in February and in March, 1941. The same procedure with the same group of sows is to be followed in the production of fall litters.

The purebred and crossbred pigs produced by these matings will be compared on the basis of performance tests. $F_1$ gilts and boars will be selected for backcrossing and mating inter se, and this will be continued in future generations in order that a black strain of Landrace stock, carrying approximately 13/16 Landrace blood, may be obtained. When sufficient numbers of such animals are available, an attempt will be made to fix characters of economic importance through selection and inbreeding.

## DISEASES OF ANIMALS

**Bang's Disease—Calfhood Vaccination.**—Field trials, which have been in progress for five years, were continued. At present, investigations are being conducted in 20 herds with 1,170 animals under observation. Of this group of animals, 366 are calves added during the current year.

There are 640 calvings recorded from the entire group of vaccinnated animals with 10 abortions. Five of these abortions occurred in animals treated between the ages of 12 and 18 months and four of them had been injected with commercial vaccine. Of the group of 640 calvings, 45 per cent were in the third, fourth and fifth pregnancies.

Milk samples from vaccinated animals have been examined for the presence of *Brucella abortus*. In quarter samples from

77 such animals, the organism was shown present in five cases. Three of the five were treated with commercial vaccine and beyond eight months of age in early trials. The other two were animals vaccinated at the proper age with vaccine prepared from Strain 19. In no instance did the organism recovered from the infected guinea pigs resemble Strain 19.

The evidence secured to date regarding the lowered abortion rate and udder infection seems to indicate that in badly infected herds where immediate removal of infected animals is not possible, a period of about five years will suffice for the replacement with vaccinated animals.

**Infectious Mastitis of Cattle.**—Mastitis or Garget of cattle is readily diagnosed by clinical observation and some simple tests of the milk. Diagnosis of the exact type of bacteria present in cases of infectious disease requires laboratory studies. The outcome of the disease process and the treatment depend upon the invading germ. Simple, non-infectious forms respond readily to local treatment and such cases need not be disposed of for slaughter.

Approximately 90 per cent of the infectious cases are caused by *Streptococcus agalactiae*. The other 10 per cent of the infectious cases are caused by other Streptococci, by Staphylococci, by Colon group organisms and by several other species of bacteria. The infectious forms cause serious losses in milk production through udder damage, forced sale of animals for slaughter and an occasional loss from fatal septicemia.

The infectious forms are controlled by segregation of affected animals, by milking these last, and by using all possible means to prevent carrying infection from these to well animals. Among the measures found satisfactory are the use of separate wash cloths for each cow, washing the hands in disinfectant solution between cows, or disinfection of the milking machine cups between cows.

In order to prevent introduction of infected animals into the herd, care should be exercised in purchase. The herd history, the milk production of the individual cow and the clinical condition of the udder should be considered. Wherever possible, the milk should be examined bacteriologically for evidence of infection.

**Infectious Encephalomyelitis of Horses and Mules.**—This disease has been present in the counties of the Eastern Shore and of Southern Maryland during a recent occurrence which began with a disastrous outbreak in 1933. Since that year the number of cases has shown a general decline. The sections affected comprise the tidewater area of the State where salt water varieties of mosquitoes are present. Only the Eastern type of virus has been shown to be present in Maryland.

The decrease in intensity of the disease has been due to several factors—the resistance developed in animals from natural exposure, the use of protective measures against mosquitoes and the use of vaccination procedures. In the main, chick embryo vaccines have been used prior to the occurrence of the disease, but in some sections the inoculations have not been made until after the first case has been seen. Because of the ever-present danger of introduction of the Western type of virus into other sections of the State, large numbers of horses have been inoculated with vaccines. In these instances, vaccines prepared against both Eastern and Western types have been used.

**Genital Trichomoniasis of Cattle.**—This disease of the genital tract of cattle, caused by a protozoan, has been noted in new herds each year. The spread into new groups has been most frequently the result of the introduction of an infected bull, but the infection may also result from the purchase of cows carrying the disease.

Diagnosis is possible on the basis of the herd history and demonstration of the causative organism from cows or bulls. In some cases, however, the herd history must be used as the sole basis, since the germ cannot be found. This latter circumstance may arise because of the stage of the disease in the cattle examined and because of difficulties in technique.

In infected herds the disease can be controlled by the use of clean bulls on clean females, by segregation of the infected group, by withholding from service for several heat periods females which have aborted or which are shown to harbor the protozoan. Infected females which fail to show heat periods should be brought in by artificial means. The regular cycle should be established before rebreeding.

**Blackhead in Turkeys.**—Studies on this problem covering several years confirmed the work of other investigators which established the etiological role of *Histomonas meleagridis*. Practical phases of the control program have been disseminated to turkey producers and have proved of value to the industry.

More intimate studies of the causative organism have been undertaken in late years. Efforts have been continued toward cultivation of the protozoan in pure culture, free from all bacteria or associated with one known species. These efforts have been directed toward the preparation of a suitable medium and isolation of single protozoa. For the latter purpose the principles of dilution, sedimentation and chemical composition of the medium have been explored. Isolation by the use of a micromonipulator has also been attempted with some success.

Pure cultures of the protozoan, free from bacteria or associated with only known species, are to be used for exposure trials. Such procedures are expected to throw more light on symptoms and lesions.

## BACTERIA AFFECT THE FARM

**New Disinfectants.**—Poor sanitation frequently is the cause of low quality in both fresh and canned food products. Excessive contamination may be introduced from plant equipment such as machinery, tanks, table tops and pipe lines. The daily removal of such wastes, followed by some good method of sterilization is essential for sanitary control. Steam is often used to clean machinery but for wooden and concrete equipment it is not effective. For such equipment chemical germicides, usually chlorine compounds, have been the most popular, but they are not ideal in the food industry. Food particles on the equipment take up the chlorine and reduce its germicidal power. Also, chlorine in water is corrosive on much metal equipment, and therefore should not be used as the exclusive sterilizing agent. This is particularly important to Maryland's food industries because many different kinds of equipment are employed, due to the great diversity of products packed.

Some of the newer chemicals may be more satisfactory as disinfectants for plant equipment. Orthophenylphenol salts, sold under the trade name of "Dowicides," possess many desirable characteristics. Two of these compounds, one known as Dowicide A, and the other known as Dowicide C were compared with two chlorine compounds, calcium hypochlorite and chlorazene. One test was carried out in the presence of high vegetable organic matter (tomato juice), and the other test in the presence of organic matter containing a high protein content, namely, oyster liquor.

A comparison of the germicidal power indicates that Dowicide C is superior to the other disinfectants tested. In the case of disinfecting cannery equipment where the waste is of vegetable nature, this compound, as shown in laboratory tests, should be the most effective disinfectant. Under conditions where the organic matter is of high protein content, the chlorine compounds tested may be just as effective as Dowicide C.

**Changes in Quality of Shelled Green Peas.**—The peas were held at the vinery for various periods of time and tests on bacterial numbers, sugar fermentation (souring) and loss of vitamin C were made. Peas shelled in a viner and held for 5 hours showed marked bacterial growth and definite souring, but the loss of vitamin C was not apparent until after 8 hours. Unshelled peas held for 23 hours showed no significant loss of vitamin C. Blanching for one minute at 100° C. was effective in killing the majority of bacteria present, but also resulted in a 32% loss of vitamin C. From this study it is apparent that the time period between shelling, blanching and final packing should be shortened as much as possible.

To determine whether the bacteria growing on the peas could destroy vitamin C, several cultures were studied further in the laboratory. The majority were found to destroy vitamin C, while others could actually protect it for a considerable time.

## PLANTS AND THEIR DISEASES

**Some Fundamentals in Storing Grain.**—Spontaneous heating is a problem in storing grain, especially when it is stored in rather large quantities. Some of the basic factors which affect the stored grain are being discovered and studied. Corn, wheat and rye have been used in finding the fundamentals that underlie successful storage. Since storing grain in the Eastern States has been requested as a defense measure, the value of this work has been enhanced.

Work by other investigators has shown an important relationship between the respiration of kernels of shelled corn and the spontaneous heating of grain in storage. By means of modern methods and equipment, investigators at this Station have been able to measure more completely and accurately the respiration and other factors which may affect heating of grain. While it is not possible as yet to make practical application of their results, they are finding out what changes take place when grain heats, and the factors associated with those changes, with a view to determining the cause and the conditions associated with heating. From this fundamental information it is expected that definite recommendations can be made whereby heating of grain in storage can be reduced to a minimum, or prevented.

In connection with this investigation, there are indications that light may be thrown upon factors associated with hardiness in wheat. Preliminary results showed that the hardy varieties had the smallest percentage of the total water as freezable water.

The hardy varieties also showed the greatest percentage of loss of respiration during the 28-hour period following soaking of mature kernels, indicating more rapid binding of water on the cell colloids.

**Plant Growth Regulators and Flowering Substances.**—An inexpensive soluble fertilizer hormone mixture proved of practical value as a starter solution, side dressing, and for garden culture. Progress has been made also in methods of extraction and preservation of possible flowering substances by use of special gas chambers. Various methods of applying the extracts to test materials were worked out. Indirect ways which led to early flowering, mainly depending upon changes in translocation, were successful under certain conditions. The indirect effect upon early development by other hormones was demonstrated.

**Sweet Potato Storage.**—Most of the present high losses of sweet potatoes in storage are due to improper curing of the roots. With proper curing the potatoes are prepared for an extended life under favorable storage conditions. An effort was made to determine the essential changes that occur in the roots during curing and to discover the most favorable curing conditions to bring about these changes.

It is not safe to assume that the most favorable curing conditions are necessarily the same for all varieties of sweet potatoes, but the work so far has been confined to Maryland Golden, a popular variety in Maryland. This variety has many excellent qualities as a Maryland crop, but it has been, as a rule, a poor keeper.

The work has shown that for effective curing of Maryland Golden sweet potatoes it is not the temperature nor humidity alone that is important, but a proper combination of these two factors. Of all the combinations tried thus far, a temperature of 86° F., and a relative humidity of 95 per cent has given best results. This high humidity should prevail only during the curing period of about 10 days. Slightly higher temperatures in combination with high humidity seem to be even more effective in curing the Maryland Golden variety, but the danger of internal breakdown is always present when temperatures above 86° F. are used for curing. Curing temperatures up to 104° F. sometimes resulted in fine looking potatoes after four months' storage, but they were masquerading under false exterior, as most of the roots showed internal breakdown.

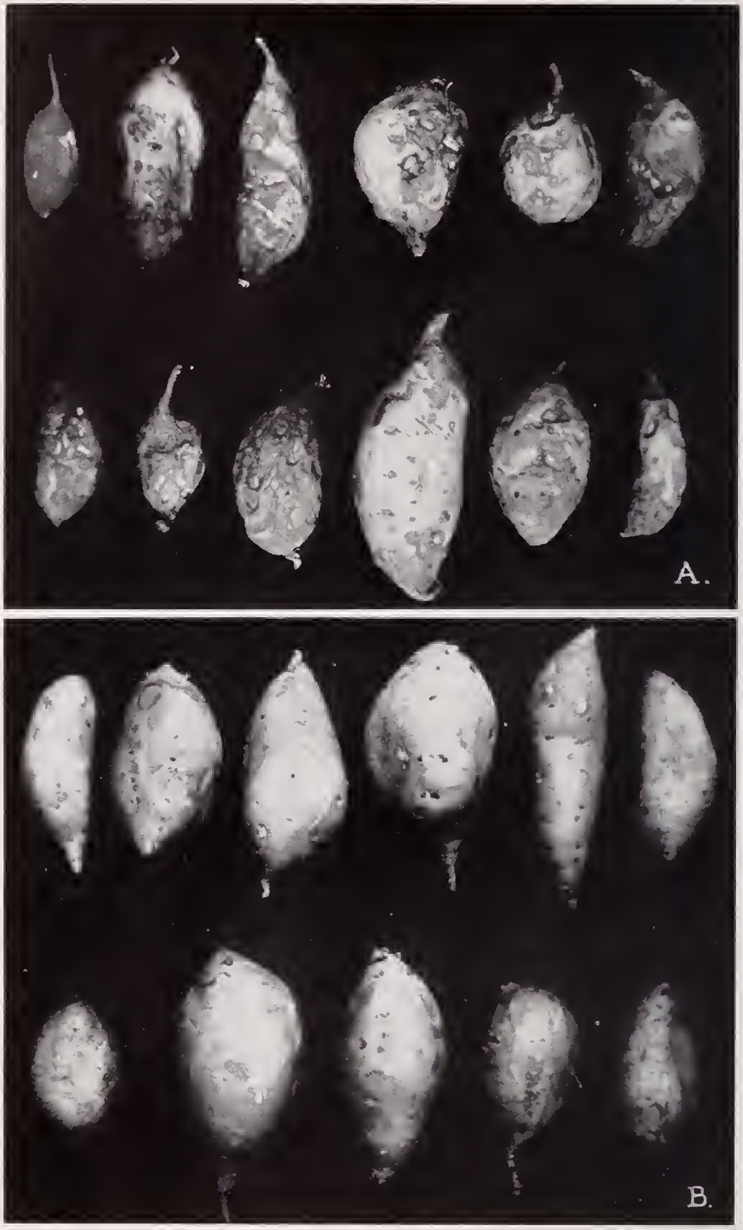


FIG. 7. *Sweet potatoes at the end of four months storage, after two different treatments:*

*A. Kept at 50° F. for entire period.*
*B. Cured for first ten days at 86° F. and 95% humidity; remainder of time at 50° F.*

**Diseases of Potatoes.**—Work on breeding potatoes resistant to Fusarium wilt, late blight and hopper burn was continued at Oakland, in cooperation with the U. S. Department of Agriculture. Only a little late blight appeared in an unsprayed field, but hopper burn was severe. Five of the 26 named varieties, Smooth Rural, Russet Rural, Pennigan, British Queen, and Ackersegen, were resistant to hopper burn, and one variety, Sequoia, was very resistant. Thirty-six of the 1,630 seedlings studied were very resistant to hopper burn.

Resistance to Fusarium wilt was studied in another field in which the organism was introduced into the soil on cultures grown on sterilized oats. Thirty-five named varieties and 1,568 seedlings were grown in this field.

Largest yields were obtained from Warba, Chippewa and Irish Cobbler in yield tests of 8 early varieties at Oakland, and the lowest yield was from Earline. The largest yields from 11 late varieties were obtained from Sequoia, Seedling B247, and Sebago, and the smallest yield from Russet Rural. All of the highest yielding late varieties are resistant to blight and Sequoia and Seedling B247 are also resistant to hopper burn. Largest yields were obtained from Katahdin, Chippewa, Seedling CS 110 and Maine Irish Cobbler in tests of 13 early potato varieties, strains and seedlings at Pocomoke; lowest yield was from Earline.

**Breeding and Genetics of Vegetable Crops.**—In further studies of the influence of temperature and nutrition on the cantaloupe wilt parasite, it was found that a high level of nitrogen in the rooting medium coupled with a relatively low potash level seems to increase susceptibility to wilt. These studies may furnish a practical means of control. Field observations indicate that nutritional control of wilt may be possible, if some degree of genetic resistance can be obtained. This work is being closely coordinated with the breeding program of the Horticultural Department.

**Virus—A Trouble of Increasing Importance.**—For the first time with any virus, plant or animal, it has been possible to inhibit multiplication of the pathogenic protein in the living cell. This was accomplished with various cyanides. New data were obtained on the "incubation period" of the virus following inoculation and on the protein relations between virus and suscept cell.

Work with raspberry viruses has been confined primarily to field control studies. Roguing experiments during the last two seasons indicate that the disease can be controlled only with great difficulty. With present methods of identification, only an expert can do field roguing efficiently. At present about 6 acres of berries in 5 locations in Washington County are under experimentation for virus disease control.

**Diseases of Tobacco.**—Fusarium wilt of tobacco was reduced on the Mudd farm from 10 per cent to 1 per cent by planting wilt-resistant strains No. 43 and No. 21. Laboratory studies of tobacco Fusaria from this plot indicate there are many strains of the fungus able to produce wilt.

Tobacco anthracnose, a new disease in the United States, was found destroying Maryland tobacco seedlings.

**Disease of Strawberries.**—In addition to testing about 1,500 new hybrids for red stele resistance, further selection was made on the previously resistant hybrids until several were obtained which are worthy of introduction as new varieties in the near future. Four acres were devoted to test plots this year.

**Basic Knowledge of Breeding and Inheritance.**—Breeding of new strains for greater production, improved quality, and disease resistance is proving of increasing value in connection with practically all types of crops. Many of the basic factors upon which results depend are still unknown. Work is being carried on with the genera Gladiolus and Tulipa, not only for the purpose of obtaining fundamental information regarding these plants, but for its possible application to virtually all breeding work.

## DAIRY COWS AND DAIRY PRODUCTS

**Soybean-Millet-Molasses Silage Compared With Corn Silage.**—Results for the first year of feeding tests show that cows fed corn silage produced slightly more milk and butterfat than cows fed soybean-millet-molasses silage. In addition, the cows fed corn silage maintained their weight at a slightly higher level. A comparison of the amounts of silage refused by the cows showed that the corn silage was more palatable than the soybean-millet-molasses silage.

The effect of these two silages upon the carotene and vitamin A activity of the milk is being studied. These results will be of particular interest to dairymen of the State producing high-quality market milk.

While raising grass and legume crops may have advantage from a soil conservation and other production standpoints, this investigation indicates that corn silage may be more valuable as a feed for milk production than soybean-millet-molasses silage.

**Kelp Meal in Rations of Dairy Animals.**—Kelp is one of many forms of seaweed. According to manufacturers of kelp meal, it contains a remarkably high content of some 20 odd mineral salts and vitamins that are beneficial to the health of dairy animals, especially with respect to their reproductive functioning, growth, and increased production.

A feeding trial is in progress to determine under controlled experimental conditions the value of the product in promoting growth, increasing production, correcting breeding troubles, and maintaining a high reproductive efficiency, which is so essential in the proper maintenance of a herd.

The kelp meal used in this trial is manufactured from the giant kelp that is peculiar to the Pacific Ocean. A group of heifers were fed on a grain ration containing 4 per cent of kelp meal from the time they were approximately one year of age to the time they freshened. This group is compared with a similar group fed the same ration without the kelp meal. Results indicate no significant difference between the groups as to growth or measurable health and breeding benefits.

**Input as Related to Output in Milk Production.**—Relative values of milk and feed, rather than agreement with any feeding standard, is the major consideration in determining the most profitable level of feeding. This appears conclusive from work that was designed to obtain definite information on the most profitable levels of feeding with specific milk and feed price situations.

Three years of experimental work with 50 cows have shown consistent increases in milk production with each increase in the level of grain feeding. However, this response to increased grain was less at the higher levels than at the lower levels. A diminishing income over the cost of feed may begin anywhere between the lightest and heaviest feeding, depending upon the relative prices of milk and feed.

**Growth of Dairy Animals from Birth to Freshening Age.**—Dairymen raising replacements and breeders of purebred animals are interested in knowing whether animals of various ages are approximately normal in size for the breed. Such information is valuable as a guide in breeding, feeding, and management practices.

Birth and monthly weights are recorded on all dairy heifers in the Station herd up to freshening age, with a view to obtaining data on normal growth of dairy animals of the four major breeds.

**Control of Bang's Disease in the Experiment Station Herd.**—Contagious abortion is one of the greatest economic disease problems confronting breeders of dairy cattle. The Experiment Station herd was infected with Bang's disease from 1908 to 1929. It was freed of the disease by means of frequent agglutination tests and isolation of positive cows. It has been free from the disease since 1930.

There has been an average of 4.94 per cent of abortions during the years that the herd has been completely negative to Bang's disease in comparison with an average of 15.09 per cent abortions during the period when the herd was infected.

Data on this herd since abortions caused by Bang's disease have been eliminated, show that many abortions may be due to other causes, some of which are still unknown. There is some evidence that the tendency to abort may be inherited.

**Oat Flour as an Antioxidant for Milk Exposed to Sunlight.**—Bottled milk is often exposed to the direct rays of the sun between the time it is delivered to the consumer's doorstep and the time it is taken in by the customer. Susceptible milk, when exposed to sunlight, develops an oxidized flavor, often referred to as "cardboard," or "sunlight" flavor. An extract of oat flour has been found effective in delaying or preventing the development of similar flavors in other dairy products.

Pasteurized milk in glass milk bottles, in paper milk bottles, and in paper milk bottles treated with an extract of oat flour was exposed to morning, noon, and afternoon sunlight at 40° F. for various lengths of time. Additional samples at 70° F. were also exposed to noon sunlight.

Results showed that milk is more susceptible to sunlight-produced flavors when exposed to noon sunlight and when exposed at 70° F. The untreated paper bottles gave considerably better protection to the milk than did the glass bottles, and the treated paper bottles gave a very small increased protection as compared with the untreated bottles.

**Riboflavin (Vitamin $B_2$) Content of Cream and Remade Cream.**—The sale of remade cream, or a mixture containing remade cream, for public consumption is an unjust trade practice and tends to promote demoralization of any market. It increases the local producer's already existing surplus and, above all, is a violation of the regulations of all health departments.

Since an excellent quality of butter, made in sections of the country where production costs are low, can be purchased and re-emulsified with skimmed milk to make remade cream, a test for the detection of such cream is desirable. It is entirely possible to make cream by emulsifying butter and skimmed milk and to mix the resulting cream with fresh cream and produce a product that cannot be distinguished from fresh cream by ordinary tests. Research is being conducted on the vitamin $B_2$ content of natural cream and of remade cream to determine if these products can be distinguished on the basis of the vitamin $B_2$ content.

## INSECTS ON THE FARM

**The Oriental Fruit Moth.**—Plots were treated with some of the newer chemicals to determine their efficiency in controlling this pest on a promising new variety of peaches that mature about two weeks later than the Elberta. The materials used were xanthone, phenathizene, derris powder and a new fixed nicotine concentrate. The Oriental fruit moth infestation on the farm was abnormally low, on account of heavy parasitism the previous year. However, two of the above materials gave results that warrant further studies under conditions of heavier infestation. In the case of xanthone and fixed nicotine concentrate the infestation at harvest was reduced from 10 per cent in the check to about 3 per cent in the treated plots. To effect these reductions, treatments were begun in late June and continued at 10 to 12 day intervals until late August. Such a schedule is too expansive and further work needs to be done to determine the minimum number of applications that will give a profitable return.

**The Corn Ear Worm.**—Oil treatments and desilking methods appear to be profitable for control of the corn ear worm on market sweet corn.

Results of experiments at the Maryland Station with mineral oil with pyrethrins or dichloroethyl ether have not been as satisfactory as results claimed elsewhere.

The oil treatment is dangerous if not properly made. Work with moth baits has given encouraging results.

**The Pea Aphid.**—For four years, better treatments on experimental plots at Ridgely have consistently given profitable increases in yields of shelled peas over untreated plots. Derris had proved superior to cube for pea aphid control; fine grinding appears to increase the effectiveness of derris powder. Derris sprays have given rather consistent results. Derris dusts are more variable and under favorable conditions are better than sprays. Nicotine in sprays and applied by the vaporizer is more dependable than derris treatments.

**Apple Insects.**—Control operations in 1939 reduced the infestation of pistol casebearer to the point that it was difficult to find plots heavily enough infested to give good experimental results. However, experiments were conducted against the eggs and young larvae, similar to those of 1939. In addition to these, plots were arranged and treated at the time of the pre-blossom spray and at the petal-fall spray. In 1939 it was demonstrated that derris powder was effective against the casebearers while feeding on the undersides of the leaves in late July and early August. Derris powder was also proved to be effective against the over-wintering stage when they begin to feed on the foliage in the spring. When derris powder is used at this time, wettable sulphur instead of lime sulphur should be used as a fungicide and it may not give adequate scab control.

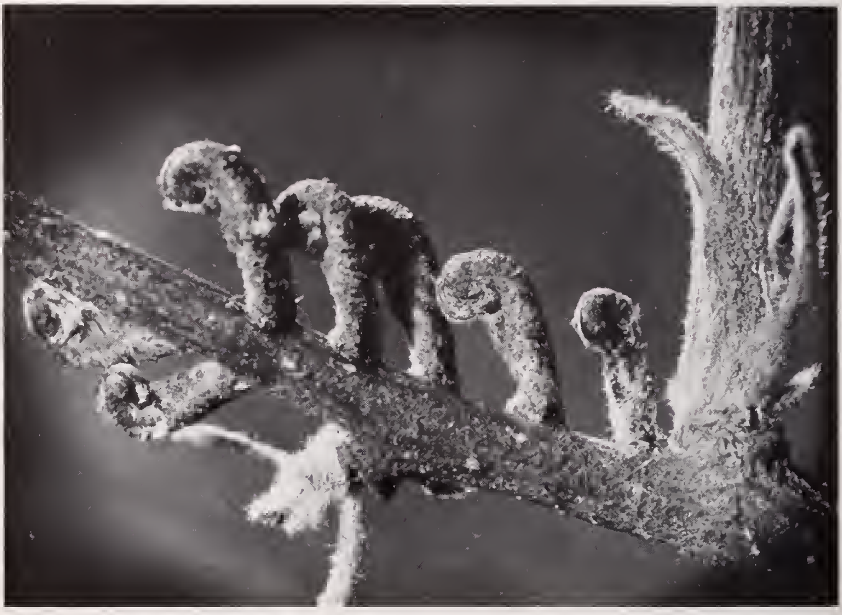


FIG. 8. *Full-grown Pistol Casebearer larvae, Coleophova malivorella, Rily, with case attached to apple twigs.*

Control measures applied against the egg stage again indicated that two applications of summer oil or one application of 1% oil and nicotine sulphate 1-800 applied when most of the eggs have been laid is effective.

Derris powder, 4 pounds to 100 gallons of spray when the eggs have all hatched is effective. Oil should not be used with derris powder.

**Spray Injury.**—Heavy scab infections somewhat complicated the year's results by causing some foliage to drop in practically all the plots. The insoluble copper compounds produced less fruit russeting, but were not effective in preventing secondary scab infections on the foliage. Wettable sulphurs used throughout the season produced more fruit free from russet than any of the other chemicals used, without, however, adequate protection against scab on the foliage.

**Insect Hibernation.**—Considerable study has been made of the relative measures of cold hardiness with regard to several species of insects. Direct determination of the under-cooling points in insects is the best measure of cold hardiness. Protection against cold is provided by super-cooling phenomenon of body fluids. "Bound water" appears to play no part in insect hibernation; once insects under-cool and freeze, the unfreezable water occurs in the same amounts in both winter and summer forms of the same species and in different species.

## FRUIT AND VEGETABLE CROPS

**Effects of Phytohormones and Starter Solutions on Tomato Transplants.**—Since most of the tomato acreage in Maryland is grown from southern plants, a rather elaborate experiment was conducted in the field and in greenhouses to measure the effect of phytohormone on the transplants, as determined by marketable fruit. It is true that when transplants have been given certain additional treatment before planting there has been a slight increase in earliness of the first picking. However, in no case was the ultimate yield greatly influenced by these transplant treatments—certainly not enough to justify the time and expense involved. There was some noticeable effects on the prevention of wilting, but they are not great enough to justify recommendations for treatment.

Use of some rather new complete nutrient solutions, which are highly soluble in water, has shown promising results on increasing the stand and early growth of tomato transplants set in the field. Where a transplanter is used, and water is applied at the time the plants are set, the additional cost of applying nutrient solutions is very small. The results are likely to be more outstanding when the season is dry for several weeks after plant setting. This line of investigation will receive more attention in the future.

**Native Blueberry as a Soil Erosion Control Plant.**—Just how much value the native blueberry has as a soil erosion control plant in some parts of Maryland is being investigated, in cooperation with the Hillculture Division of the Soil Conservation

Service. The symptoms which blueberry plants develop when certain soil nutrients are lacking were determined by experiments completed during the year. These results will remove some of the guesswork when troubles are diagnosed in the field.

**Cantaloupe Breeding.**—Approximately 200 progenies, representing inbreds, hybrids, and single and double back-crosses of cantaloupes, have been carried in breeding cultures. A large number of foreign plant introductions have been grown also in an effort to find a culture which is resistant to leaf-defoliating diseases.

One new hybrid has been developed which runs 30 to 50 per cent higher in sugars, will set more fruit, and is far less susceptible to Ground Rot cracking than Hale's Best. Whether this new type will be suitable for planting in Maryland will depend upon tests being conducted at various locations in the State in 1941. This new hybrid is not resistant to wilt nor to leaf blight. Small samples of seed will be available for growers in the State desiring to try out this new hybrid under their conditions.

**Skin Cracking of York Apples.**—The first definite clue to the cause underlying this serious trouble has been provided by experimentally produced skin cracking, identical to that which has been occurring in Western Maryland. It was produced during the last year on treated trees only in a block of Yorks where cracking has not been present.

An effort is now being made to confirm these findings, and also to determine what other condition may contribute to the factor seemingly responsible for the cracking.

**Planting Modern Peach Trees.**—Careful records on the yield per tree and acre basis, on the size of fruit and the size of trees indicate that for economical production of high yields of large-size, better quality fruit, not more than 75 peach trees should be planted per acre. That means planting 24 by 24 feet, or such variation of these distances as would give not more than 75 trees per acre.

Records were obtained from 1,300 trees set out near Colesville in 1927. They included Hiley, Belle of Georgia, and Elberta, and modern pruning, fertilizer and cultural practices were employed. The planting distances were: 20 by 20 feet; 20 by 24 feet; 24 by 24 feet, and 24 by 24 feet with a filler tree in the center of each square (quincunx).

Much greater yields per tree were produced with the wider spacing, the trees set 24 by 24 feet in later years yielding twice as much as those set 20 by 20 feet or 24 by 24 feet with fillers. Striking differences in size of fruit resulted, the largest-sized fruits being produced by the 24 by 24 feet spacing, with the 20 by 24 feet trees next best. Because of crowding and the small-size fruit, the filler trees were removed from the Hiley and Belle blocks in 1935 and from the Elberta blocks in 1936. The trees remaining have since tended to show better growth and an increase in the size of fruit, but with the smaller fruiting capacity it is evident they can never catch up.

**New Fruit Varieties.**—Fifty peach varieties are now undergoing intensive study at the Plant Research Farm to determine their relative value for Maryland conditions. Most of these are now coming into production and it will not be long before the merits of each variety will be known. Some of these varieties are also being observed in commercial orchards in order to evaluate their performance under different soil and climatic conditions.

Raspberry studies in Western Maryland were largely completed in 1940. Only one of the newer introductions of black raspberries, namely, Bristol, is sufficiently promising commercially to be worthy of further trial. Both Dundee and Evans are vigorous and high yielding, with large, high-quality fruits, but the latter are too soft unless they can be picked every other day and marketed promptly. Cumberland and Logan must still be regarded as the standard varieties for commercial planting.

Among the newer introduction of red raspberry varieties, Newburgh, Taylor, and Marcy are all too easily winter-killed to be reliable commercial varieties. Latham must still be considered the standard. Indian Summer, a fall-bearing sort, is worth while for home use, but too soft for distant shipment.

A test planting of about 30 new grape varieties will be in fruiting next year, so just ahead there lies much new and valuable information.

**Value of Red Strains, or Bud-Sports, of Apples.**—Since the introduction of red strains of apple varieties, these strains, or bud-sports, have predominated in all the new plantings of red varieties in Maryland. Many of these plantings are now coming into fruiting and a wider comparative study can be made of them. There is an opportunity to compare such features as color, shape, finish, and size of different bud-sports on Delicious, Stayman, Rome, Jonathan, York, etc. Also, to observe the relationships of such factors, as soil differences, fertilizer and cultural practices, altitude, etc.

It is already clear that one strain of a given variety will not necessarily be superior under all conditions. One strain may be superior under conditions such as are found in Western Maryland, whereas a different strain may be superior elsewhere in the State. Blanket recommendations to all growers will be the exception, rather than the rule. Only time and study will reveal the complete picture.

Trees in the orchard at the Horticultural Farm, consisting of approximately 100 red strains, continue to come into fruiting. Several of these new unnamed strains show fruit characteristics superior to those now in propagation, but several years will be required to make sure they are constant.

**Better Prices for Better Peas.**—Peas were just peas, at so much per ton, prior to 1935. Canners said they were willing to pay more for the better quality raw product, if they only had some way to tell the quality of any particular load after it was canned.

Work on this problem was begun in 1935 by attempting to separate peas of different maturity by floating them in brine of various strengths. This worked surprisingly well, but the method was difficult to carry out on a large scale.

While this was being done, the tenderometer was being developed and perfected. This machine is designed to simulate the mechanics of mastication by shearing a definite volume of peas between two grids and recording the force required to do this in pounds pressure per square inch. There was no question that this machine would determine the difference between tough and tender peas, but canners and growers wanted to know what any tenderometer reading means in terms of quality. The tenderometer was used on hundreds of samples and portions of the same samples were canned and graded. From these results, a table has been set up showing the limits of tenderometer readings for the several grades of canned peas known to the trade as Fancy, Extra Standard, Standard, and Sub-Standard, in the various sieve sizes.

It has thus been made possible for contracts between canners and growers to be made on the basis of a higher price for peas that will make a higher quality canned product. In other words, the grower receives a premium for better quality peas and progressively lower prices for those of poorer quality.

The work mentioned applies to Alaska peas. Since the acreage of sweet peas has assumed reasonably large proportions, work was begun on "sweets" in 1940 and will be followed for several years to establish a table for this group.

**Why Yields of Delicious Apples Vary Widely.**—The reason for wide variation in yield of Delicious apples has been sought during the last two years. Nine varieties have been studied as pollinizers, including practically all those which Maryland growers might conceivably use. They were Jonathan, Rome, Gallia Beauty, Golden Delicious, York, Winter Banana, Lowry, Yellow Transparent, and Williams. More than 51,000 blossoms were pollinized.

An excellent fruit set was obtained with every one of these varieties, proving they are satisfactory pollinizers for Delicious.

Observations in the field indicate that two practices have resulted in insufficient fruit set. First, in removing poor and non-profitable varieties from orchards in recent years the number of remaining trees of other varieties has been too small to accomplish adequate cross-pollination. Second, even though an adequate number has been left, most or all of them in some cases have been members of the Winesap group (Stayman, Blacktwig, Winesap), which have defective and non-viable pollen and, hence, have no value as pollinizers. Either interplanting, or for quicker effect top-grafting some of the trees, will correct this difficulty.

A 70 per cent increase over normal set of fruit was obtained by branch-ringing at the petal-fall stage. An increase of 20 per cent over normal set occurred from ringing in the pink stage. Ringing alters the nutritional conditions during fruit setting by preventing the movement of carbohydrates away from the twigs and blossoms. Fruit set in relation to fertilizer practice is also being studied.

Whether different amounts of shade in the inside portions of the tree, resulting from light or heavy pruning, affects the number of fruit buds formed is being studied. Sufficient evidence is at hand to show that formation of fruit buds is definitely influenced by shading under some conditions of tree growth.

**Width for Strawberry Rows.**—Thinning strawberries has proved profitable in dry seasons with a variety like Blakemore, which develops an abundance of runner plants. An experiment was designed to determine the width of thinned row that will give the highest yields of largest berries.

Plants were maintained in rows of 10-inch, 20-inch, 30-inch, and 40-inch widths. Excess runners were removed so that the plants were thinned to a distance of 4 to 6 inches in the row.

In yields of U. S. No. 1 berries for the first fruiting year, the 10-inch width or row out-yielded the 20-inch row by 13 per cent, out-yielded the 30-inch row (about the usual width in commercial practice) by 24 per cent, and out-yielded the 40-inch row by 33 per cent.

There are several reasons: The narrow width produced the largest berries; it had the largest proportion of earliest-formed and established runner-plants which are well known to yield heaviest, while the wider widths had increasingly larger percentages of late-formed, small runner-plants having a much lower fruiting capacity; a large number of the total plants in the narrower rows are next to the aisles, which has a thinning effect.

The work is being continued to determine how these plants should be handled to give the largest yield and largest berries during the second fruiting year.

A study of root development of Blakemore under thinned and matted rows showed that thinned plants root more deeply, which means more moisture is available, and hence, larger size and yield of berries.

**Better Quality of Stored Apples.**—What is the earliest stage of maturity at which Grimes Golden and Jonathan apples can be picked and still ripen into attractive fruits with "taste appeal"? It is known that with maturity and ripening fruits undergo certain internal and external changes and that many of these changes must take place on the tree to yield desirable storage fruit. Firmness and electrical resistance of the flesh, the amount and ratio of the fruit acids, skin coloration, and starch content have been yardsticks for measuring the extent these changes are necessary before apples can be picked safely.

The starch content in Jonathans at harvest seems an important influence on the development of palatability in storage and the future tastiness of the fruits can be forecast reasonably from the starch content at that time. A procedure for measuring the maturity of apples has been developed, methods for sampling to obtain true representation of the tree and orchard are being worked out, and in a short time a standardized operation for accurately determining proper harvest maturity of Jonathan should be available to growers and the Inspection Service.

The problem of keeping quality in Grimes Golden centers mainly upon prevention of storage wilt and scald, since this variety may be picked at relatively immature stages and still develop suitable palatability after ripening.

Spraying or dipping apples in a water miscible wax, Brytene 489AR, according to manufacturer's directions, was found to greatly reduce weight loss and shriveling in storage, but apples so treated scalded more frequently especially if not well matured before harvest. Storage scald was reduced by holding the apples at approximately 60° F. for one week before waxing, and the coloration of the fruits gave them a far more salable attractiveness than unwaxed fruits placed in cold storage immediately after harvesting. Furthermore, the attractive condition and appearance of the waxed fruits was maintained for a longer period than that of unwaxed fruits.

**Supplying Organic Matter for Production of Vegetables.**—Many of the soils used for production of commercial truck crops have reached the point of marginal production because of lack of humus. They do not give economical and maximum response to commercial fertilizers because of lack of humus in the soil colloid.

In an effort to determine the most economical and rapid method for bringing the soils back to their average former level of organic matter, an attempt is being made to raise one cash crop and two cover crops in one year. The cover crops are being grown with and without fertilizer, and with and without nitrogen to break them down in the soil.

In 1940, on the Eastern Shore, drilled corn that had received an application of 200 pounds per acre of nitrogen produced 16 tons of green corn per acre as compared with only 10 tons where no nitrogen was used. Grain sorghums, soybeans, domestic rye, and clovers are also included in the rotations. They made heavy yields considering the rather unfavorable dry weather during July and August. Italian rye was drilled after the corn was plowed under and an additional crop was plowed under in the spring of 1941 prior to growing sweet corn for canning.

These early results indicate the possibility of incorporating organic matter in the soil in a short time and getting a cash crop at the same time.

**New Types and Varieties of Vegetables.**—Nine varieties of edible soybeans were grown at College Park last season and yields of unshelled pods and shelled beans were obtained. Samples of each variety were canned and given extensive study by canners, food technologists, plant breeders, and laboratory workers on food products.

It was shown that these soybeans can be grown profitably in Maryland, but there are distinct differences in growth, yielding capacity, and quality of canned product among the varieties. No recommendations can be made from one year's work, but those desiring details can obtain a mimeographed report by writing to the Experiment Station.

FIG. 9. *Food technologists, staff members, and advanced students judging canned samples of sweet corn to determine the influence of time of harvest on quality.*

Seven comparatively new varieties of "Baby Limas" were planted on the Eastern Shore at three different dates to determine their value for canning and freezing. Three of these varieties were planted in large quadruplicate plots at three rates of seeding to determine the best rate for each variety. It appears that these newer, improved "Baby Limas" should be planted between June 20th and 25th, whereas Henderson can be planted as late as July 10th on the Eastern Shore. The rate of seeding for Henderson was not as important as it was for Early Baby Potato and Maryland Thick Seeded. Early Baby Potato produced a heavier yield with fewer plants per acre, and Maryland Thick Seeded required more plants per acre than Henderson.

These trials are being continued and no definite recommendations on rates of seeding can be made.

**Applying Fertilizer to Peas Grown for Canning.**—When fertilizer is applied in single bands 1½ inches to the side of the seed and 1 inch below the seed level, greater yields are obtained than when the same quantity of fertilizer is either drilled or broadcast, or where it is placed in bands as far as 2½ inches or 3½ inches to the side of the seed. This is shown by results of three years' work on methods of applying fertilizers to peas grown for canning on the Eastern Shore.

Band applications of fertilizer were made with a machine developed by agricultural engineers of the U. S. Department of Agriculture. Commercial machines are not yet available, but manufacturers promise that they will be placed on the market shortly.

Experiments on the Eastern Shore indicate that a fertilizer containing 8 to 10 per cent of nitrogen, applied at the rate of 500 pounds per acre, gives profitable returns over a 4 or 5 per cent nitrogen ratio at the 1½ inch band placement. Curiously enough, the higher nitrogen ratios produce higher yields when placed close to the seed than when drilled or in bands farther away. Since drills which will place the fertilizer in bands are not available, it would probably be wise to drill or plow under one-half the nitrogen a week or 10 days before drilling the remainder of the fertilizer and sowing the seed.

The high nitrogen ratios containing 8 to 10 per cent phosphorus and 5 to 6 per cent potash would not be suitable on the heavier soils of Western Maryland, but the general practice of applying fertilizer would probably hold.

Complete details may be obtained by writing for Maryland Station Miscellaneous Publication No. 732.

**Control of Cantaloupe Defoliation.**—It has been found that control of defoliation is far more complex than simply putting on a stated number of sprays and dusts. In many cases, defoliation has been thought to be due to disease, whereas it was due largely to faulty nutrition and lack of magnesium which could have been supplied by application of dolomitic limestone to the soil.

Although results of the first two years' work have shown rather clearly that 70 per cent of pathological defoliation can be controlled by spraying or dusting, it would be a waste of money, time and materials to make applications of fungicides if the soil nutrients were not in proper balance. Certain differences have been found between the various copper compounds, but results so far indicate that spray or dust coverage, both on the upper and lower surfaces of the leaves, is probably just as important as the form of copper. It is suggested that growers give greater attention to coverage and amount of spray used per acre.

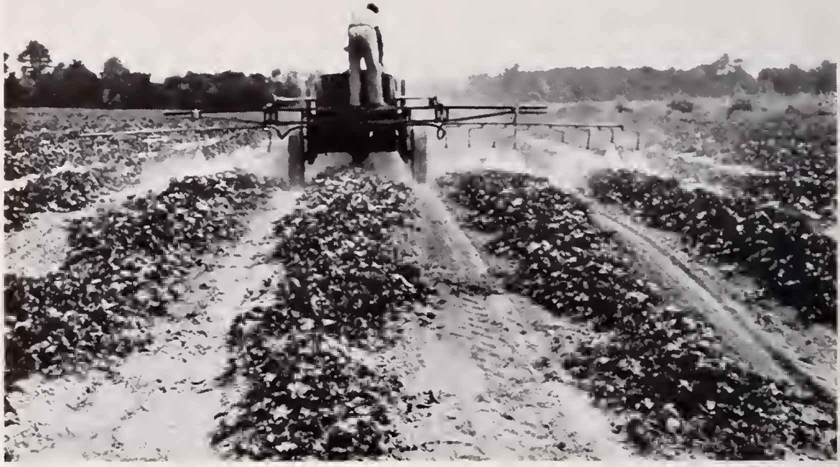


FIG. 10. *Good spray coverage of cantaloupe foliage in a commercial field on the Eastern Shore; 300 pounds pressure at the nozzle, 20 nozzles on 5 rows.*

**Root Stocks for Apples.**—Much has been done in selecting and breeding fruit tree tops, but very little thought has been given to the fact that roots complement the tops and may control to a marked degree the profit and satisfaction of fruit production. An attempt is being made to find and propagate desirable fruit tree roots for different kinds of soils and different types of trees.

## POULTRY

**Factors Affecting the Laying of Eggs.**—Poultrymen and farmers in Maryland receive about $7,000,000 annually from eggs. Seasonal variations in rate of production cause wide variations in price and unprofitable surpluses. Circumstantial evidence indicates that the production of every egg is under the immediate control of the hormone mechanism of the bird. This mechanism and its relationship to the internal mechanism of the developing egg is very incompletely known. No one has previously been able to cause by hormone treatment a chicken to form and lay a normal egg that it would not have formed without intervention.

Preliminary results from a study of the physiology of ovulation indicate that the time of ovulation of a pullet's first egg may be affected by conditioning the pullet with estrogen. Birds injected with estrogen, which had reached sexual maturity prior to the treatment, preceded their half-sister controls of identical age by an average of about 20 days. The injected pullets had shortened legs as compared with their controls, evidence of precocious skeletal maturity. If these preliminary results are confirmed by further work now in progress, they are of very great importance.

**Effects of Illumination on Reproduction of Chickens.**—The seasonal fluctuation in egg production is partially controlled on many poultry farms by the use of artificial lights during fall and winter. However, stimulation of egg production during fall and winter is followed by decreased production during spring and summer, due to development of refractoriness to light by over-stimulated birds.

Experiments in the past year indicate that adequate darkened rest periods tend to inhibit the development of refractoriness. It is expected that further experimentation will lead to the development of light schedules which will permit at least moderate stimulation of fall and winter egg production without consequent spring and summer decrease.

**Efficient Use of Feed by Chickens Reared to Broiler Weight.**—Feed cost comprises more than half of the total cost of producing broilers. A saving of 10 per cent in the feed bill for broiler production may eventually be achieved which would mean a saving of $250,000 annually to Maryland broiler producers.

FIG. 11. *Examining specimens from two different lines of research, one on breeding for efficiency of meat production and the other on physiological problems related to a disease complex.*

On the basis of results obtained during the current year, it is reasonable to expect that poultry breeders may breed strains of Barred Plymouth Rocks of high inherent feed efficiency for growth. Satisfactory progress has been made in the segregation of families of inherent high feed efficiency for growth and in propagating these families.

**Efficient Feed Utilization by Laying Hens.**—A one per cent increase in efficiency in the utilization of feed for egg production would save Maryland producers at least $50,000 annually. Feed cost per dozen eggs is greatly affected by the live weight of the laying bird and by the number of eggs she lays in a given period. The smallest bird which will lay the maximum number of eggs of standard weight is generally the most efficient. However, wide variations exist in the efficiency of individuals of the same weight and the same rate of egg production.

An effort is being made through progeny testing to segregate and propagate efficient families. Preliminary results indicate positive correlation between feed efficiency for egg production of mothers and daughters. Suitable matings will be continued in an attempt to establish more efficient lines.

**Efficiency of Feed Utilization by Turkeys.**—Notwithstanding the fact that the turkey is the most efficient producer of lean meat commonly grown in America, feed is the largest cost item in production of Maryland's annual million-dollar turkey crop. It is hoped that the efficiency of this bird can be still further increased through progeny testing and cross breeding, since this has been shown true for chickens.

Results of the current year indicate that crossbred turkeys may be superior in market quality to either of the purebred strains. This would probably not be true of all crosses, but is likely to be true when market quality of the pure strains is mediocre or poor.

**Soybean Oil Meal in Poultry Rations.**—Results of work being conducted with soybean oil meal are very important and further work is very necessary, since fish meal, dried skimmilk, and meat scrap will undoubtedly be expensive as long as war conditions prevail.

The menhaden meal used was much more effective than the meat and bone meal in supplementing soybean oil meal, both from the standpoint of growth and of feed efficiency.

Meat and bone meal and menhaden meal both depress pigmentation of shanks and body fat. Soybean oil meal is variable, but most lots did not depress pigmentation.

The molasses fermentation by-products and dried skimmilk are very effective in supplementing mashes containing soybean oil meal and menhaden meal. Dried whey and brewers' yeast are less effective.

Good broilers have been grown on a mash containing 32 per cent soybean oil meal with no animal protein supplements; however, efficiency of feed utilization was relatively low.

**Grains in Poultry Rations.**—No significant difference was found between groups of birds fed local grains and groups fed Western grains, nor between groups fed local stalk-cured and local shock-cured yellow corn. Growth was very satisfactory in the group fed a 50-50 mixture of local corn and barley as the only grain in the mash. In the case of corn and wheat, growth was somewhat better when Western grain was fed than with the feeding of local grain.

**Variability of Growth in Chickens.**—Efficiency of feed utilization, appetite, and adult body size were found responsible for the basic pattern of variability in growth of chickens. The variability may be increased and prolonged by any defect in diet which prevents normal development, and it may be decreased by individual rationing of feed or partial starvation.

It was found that correlation between live weight at different ages increased with age and with proximity between ages. Also, that size of thymus and bursa Fabricius is a result rather than a cause of rapid growth.

**Feeding Value of a By-Product of the Manufacture of Industrial Alcohol.**—Considerable value as a supplement to low-cost broiler mashes was shown in a test of a by-product of the manufacture of acetone and butyl alcohol, which is sold under the trade name of Curbay B-G. The low-cost mash used in these tests contained no milk products and contained soybean oil meal and menhaden meal as the only protein supplements. Maximum benefit was secured by the addition of 4 per cent of Curbay B-G and the resulting broilers were superior to birds fed the Maryland Experiment Station mash, as measured by growth, efficiency of feed utilization, feed cost per pound of gain, and market quality. Curbay B-G was used satisfactorily, also, to replace 2 per cent of dried skimmilk in the Maryland Experiment Station mash.

Very favorable results were obtained when Curbay B-G was used to supplement broiler mashes containing 5 per cent of good quality alfalfa leaf meal and in which the only protein supplements were soybean oil meal and menhaden meal.

When hens were fed an all-mash diet consisting of yellow corn 46, oats 10, bran 10, wheat flour middlings 10, soybean oil meal 7, alfalfa leaf meal 5, menhaden meal 6, ground oyster shell 2, steamed bone meal 2, salt 0.5, cod liver oil 1.5, and manganous sulphate 0.024, hatchability of fertile eggs was raised from about 50 per cent to 80 or 90 per cent by the addition of 6 per cent dried skimmilk or 3 per cent Curbay B-G.

**Feeding Value for Broilers of Certain Feedstuffs Rich in the Vitamin B Complex.**—A growth stimulus which cannot be entirely explained on the basis of its riboflavin content was shown by a product manufactured by the Borden Company and sold under the trade name of Flaydry, when used as a supplement to broiler mashes. The factor responsible for the extra growth is not furnished as abundantly by a combination of 3 per cent dried whey and 2 per cent dried brewers' yeast as it is by 3 per cent Flaydry. The combination of whey and yeast supplies considerably more riboflavin than does the Flaydry.

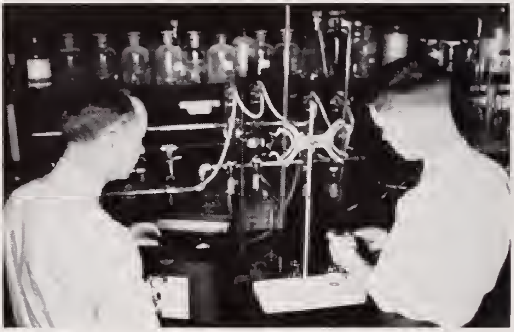


FIG. 12. *Making titrations for riboflavin analysis in the poultry nutrition laboratory. These studies are of great value to poultrymen in assuring good hatchability and rapid growth from mashes purchased.*

When fed as supplements to a typical commercial starting and growing mash from which had been omitted all milk products and yeast and all of the alfalfa leaf meal except 1 per cent, Flaydry, dried skimmilk and dried buttermilk supported excellent growth at levels of 3 and 5 per cent. Growth was inferior when dried whey and dried brewers' yeast were fed at the same levels.

**Value of Dried Kelp in Poultry Feeding.**—Addition of dried kelp to two broiler mashes tested had no stimulating effect on growth. A tendency toward increased growth was obtained by addition of 3 to 5 per cent of kelp to a third mash in three successive experiments. The differences, however, fell considerably short of statistical significance.

**Dried Milk in Poultry Rations.**—Dried skimmilk exerts a greater stimulating effect on chick growth than can be explained on the basis of its riboflavin content. This is not true of dried whey. Curled-toe paralysis occurred in rapidly growing chicks receiving as much as 500 micrograms of riboflavin per 100 grams of feed. It has been generally accepted that 300 micrograms per 100 grams of feed is adequate for normal growth and development. Thirteen samples of dried skimmilk ranged in riboflavin content from 18 to 29 micrograms per gram, 5 samples of dried whey from 12 to 30 micrograms per gram, and 10 samples of dried buttermilk from 32 to 39 micrograms per gram. No differences in riboflavin content were found between sweet cream dried buttermilk and sour cream dried buttermilk, between dried skimmilk and dried casein whey prepared from the same original milk, or between summer and winter samples of dried skimmilk and dried buttermilk coming from the same source. Dried skimmilk and buttermilk do not inhibit shank and skin pigmentation in chicks as do meat scrap and fish meal.

**Effect of Feeding Milk Products on Hatchability.**—Preliminary results indicate that hatchability is reduced almost to zero when hens in laying batteries are fed an all-mash diet compounded of ordinary poultry feedstuffs, but low in manganese and riboflavin. When the same diet is fed to hens exposed to direct sunlight, the hatchability ranges from 50 to 80 per cent. Addition of manganese alone to the diet of the hens in batteries has little or no effect on hatchability.

**Effect of Nutrition on the Viability of Poultry.**—Variations in the vitamin A content of the diet of breeding stock bears no relation to the viability of the progeny fed an ordinary practical diet, at least so long as the vitamin A intake of the breeding stock is above the level necessary for good hatchability. Furthermore, preliminary evidence indicates that the vitamin A requirements for egg production and hatchability are the same.

**Factors Affecting Quality of Eggs.**—If Maryland producers could improve the quality of the eggs they sell by one grade, returns to them could be increased more than $100,000 a year.

Results obtained during the year indicate a positive correlation between the candling quality of the eggs of a dam and her daughters. If this preliminary result is confirmed, it will be possible to establish strains of birds which produce only eggs of high candling quality.

Experiments designed to determine the effect of the lengthening daylight period in the seasonal decline in fresh-laid egg quality which occurs in early spring yielded negative results.

Eggs were found to deteriorate insignificantly during the first 24 hours under storage conditions.

Experiments with earth-banked and water-evaporation egg coolers indicate that such coolers would enable farmers to maintain satisfactory quality in their eggs for a one-week period between laying and marketing, except during the months of August and September.

FIG. 13. *Work in the poultry products laboratory on problems affecting the quality of eggs and poultry meat. Results of research along these lines tend to improve the quality of poultry products and increase returns to producers.*

**Grading and Marketing Maryland "Fresh-Killed" Broilers.**— The U. S. Grade yield in the two top grades was 34.29 per cent higher for fresh-killed broilers and fryers produced and dressed in the Valley of Virginia than for those produced and dressed on the Del-Mar-Va Peninsula. Valley of Virginia fresh-killed poultry normally brings one cent more per pound than Del-Mar-Va poultry on the New York City market. For some time to come, however, the former will probably have a limited outlet compared with Del-Mar-Va poultry because it is the higher priced product.

From January to May, 1941, inclusive, the cost, including profits, of marketing Valley of Virginia fresh-killed poultry was .74 of a cent per pound greater than the cost of marketing Del-Mar-Va poultry. This greater cost is due in part to the increased expense of more accurate grading. For the same period, Valley of Virginia producers received, on an average, .25 of a cent per pound more for their broilers than Del-Mar-Va producers.

Grading systems in Del-Mar-Va dressing plants are more lenient and actual grade yields in top grades were highest in those plants and lowest in Valley of Virginia plants. Yields in their top grades for Middle Western plants were approximately 30 per cent lower than top grade yields in the Del-Mar-Va plants.

Apparently there are no seasonal variations in actual plant yields by grade in the Del-Mar-Va area.

**Viability of Barred Chickens.**—It is hoped that by establishing lines of purebred Barred Plymouth Rocks of proven high viability the annual mortality loss suffered by Maryland's $5,000,000 broiler industry can be greatly reduced. While that loss is now relatively smaller than in past years largely because crossbred birds are used rather than purebred Barred Plymouth Rocks, it still amounts to at least $100,000 annually.

Data accumulated thus far indicate that crossbred progenies of Barred Plymouth Rock sires vary in viability directly with viability of purebred progenies from the same sires. Crossbred progenies suffered less mortality and grew and feathered more quickly than pure Barred Plymouth Rock progenies from the same sire in each case. Mortality among the progenies from the 12 sires varied from 23 to 60 per cent for the purebreds and 13 to 37 per cent for the crossbreds during the brooding period.

Pullets from one of the most viable Barred Plymouth Rock progenies have shown significantly greater viability in the laying house than pullets from any of the other purebred progenies. Pullets from the progeny showing greatest brooding mortality have also shown excessive laying house mortality. These progenies and their dams are being used to establish strains differing inherently in potential viability.

**Gizzard Ulceration in Chickens.**—There is an apparent wide variation in the severity of gizzard lesions in day-old chicks produced in different hatcheries, but in no case was any hatchery found to produce chicks free from this disease. The initial lesion occurs as a minute or large hemorrhage immediately under the lining of the gizzard and is visible on the 20th day of incubation.

A well-balanced diet containing oats, alfalfa leaf meal, wheat products, and certain other feed ingredients reported to have "protective" value when fed to growing chicks will aid in the cure and reduction of gizzard lesion severity as contrasted with a poorly-balanced diet composed largely of the "non-protective" feeds, such as corn, milk and soybean oil meal.

**Resistance to Pullorum Disease.**—That chicks from areas in which pullorum has been eliminated are generally highly susceptible to pullorum disease has been shown by previous work at this Station and also at the Illinois Experiment Station. An effort is being made to establish a pullorum-resistant, pullorum-free strain. If such a strain can be developed with good commercial qualities, it will enable poultry breeders to sell their chicks with knowledge that they will thrive in the presence of natural infections of pullorum as well as in the absence of such infections. Except under limited conditions, there is no hope of supplanting pullorum control programs through the development of resistant stock, but inherent resistance would be a valuable supplement to control programs.

As a result of the current year's work, males used in 1941 were selected from progenies which suffered no mortality after inoculation. Females were also selected on the basis of resistance of their inoculated progenies, or sibs. Thirty-eight per cent of the progenies inoculated during 1940 suffered less than 20 per cent mortality from pullorum, 76 per cent less than 50 per cent mortality, and only 24 per cent more than 50 per cent mortality. The dosages used were standardized at a level previously shown to kill more than 50 per cent of lots of susceptible chicks. Progress in increasing resistance of the strain is again being tested by inoculations during the 1941 season.

## CONCLUSION

It is hoped that you have found in these pages the promise of many improvements in agriculture. Much of the work is of necessity an attempt to simply hold our own against new diseases, new insects, new defects in soil fertility, and other new developments that result from the intricate agriculture of modern times. These new troubles and shortcomings place the Station under constant pressure to do additional work. Our attempt is to keep such developments under control and at the same time make progress toward a better agriculture.

It is undoubtedly clear that much of the work while important before has now become a necessity because of the national emergency, and the international food situation. No organization has a larger part to play than the Agricultural Experiment Stations in the accepted thought that "food will win the war and write the peace."

## CHANGES IN PERSONNEL

Professor C. E. Temple, Professor of Plant Pathology and State Plant Pathologist retired on October 1, 1940. Professor Temple came to the University of Maryland from the University of Michigan in 1914, and from then until the time of his retirement had charge of the control of plant diseases in the State. He also contributed to the agricultural welfare of the State by his extensive investigations on the diseases of a number of important agricultural crops especially the development and the introduction of disease resistant strains of canning peas. Under his direction the Plant Pathology Department developed into an active unit involved in teaching, extension, regulatory and research work in the College of Agriculture.

Mr. G. H. Goldsborough, Assistant in Agricultural Economics, resigned on May 31st, 1941 to accept a position in the Division of Agricultural Defense Relations of the U. S. Department of Agriculture.

Mr. H. M. Butler, Assistant Dairy Inspector, resigned his position on June 16th, 1941, to accept a position with the Maryland Cooperative Milk Producers in Baltimore.

Mr. L. E. Cron, Assistant in Agricultural Economics, resigned his position on February 16th, 1941 to accept a position with the Crop Reporting Service in Charleston, West Virginia.

Dr. H. L. Stier, Instructor in Horticulture, and Professor J. M. Gwin, Assistant Professor of Poultry Production and Marketing, are on leave of absence and are now serving in the U. S. Army.

*Appointments:*

C. E. Cox, M. S., Instructor in Plant Pathology.

W. D. McClellan, B. S., Instructor in Plant Pathology.

Carl B. Smith, M. S., Instructor in Agricultural Economics.

H. A. Hunter, M. S., Associate Professor of Canning Crops.

W. F. Jeffers, Ph. D., Instructor in Plant Pathology.

G. H. Goldsborough, M. S., Assistant in Agricultural Economics.

# PUBLICATIONS

## Bulletins

| Number | Title | Author |
|---|---|---|
| 435 | Measuring Inequalities in Farm Property Assessments in Maryland | W. P. Walker<br>Earl E. Miller |
| 436 | Production and Marketing of Maryland Sweet Potatoes | C. H. Seufferle<br>R. F. Burdette<br>A. B. Hamilton<br>S. H. DeVault |
| 437 | Rural Community Organization in Washington and Frederick Counties, Maryland | Linden S. Dodson<br>Douglas Ensminger<br>Robert N. Woodworth |
| 438 | The State Fiscal Capacity of Maryland and Other Selected States | V. J. Wyckoff<br>W. P. Walker |
| 439 | Studies on Corn Ear Worm Control | L. P. Ditman<br>J. P. Secrest<br>E. N. Cory |
| 440 | Classification of Agricultural Areas, Frederick County, Maryland | R. W. Harrison<br>Paul L. Searfoss |
| 441 | Status and Trend of Agricultural Cooperation in Maryland | P. R. Poffenberger<br>J. R. Ives<br>S. H. DeVault |

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## CURRENT PROJECTS

### Agricultural Economics

Organization, Operation and Business Analysis of Maryland Farms. (Purnell A-18).

Insurance and Credit Problems of Maryland Farmers. (Purnell A-18-a).

An Economic Study of the Potato Enterprise in Garrett County. (Purnell A-18-1).

Balancing the Crop, Livestock and Equipment Investment. (Purnell A-18-m).

Cost and Advisability of Raising Dairy Heifers. (Purnell A-18-n).

A Study of Farm Credit on the Lower Eastern Shore of Maryland. (Purnell A-18-o).

Maryland Farm Statistics. (State A-18-p).

Labor Requirements for Selected Crops in Maryland. (Purnell A-18-q).

The Farm Tax Problem in Maryland. (Purnell A-19).

Equalization of Farm Property Assessments for Taxation. (Purnell A-19-b).

Economic or Social Facts Which Justify the Improving or Surfacing of Rural County Roads in Maryland. (Purnell A-19-c).

Marketing of Agricultural Commodities. (Purnell A-26).

Storage Facilities and Consumption of Local Farm Products in the Cities of Frederick and Salisbury. (Purnell A-26-f).

The Relationship of Quality to Retail Prices of Canned Vegetables. (Purnell A-26-g).

Marketing Maryland Broilers. (Purnell A-26-h).

Maryland Farm Price Relationships. (Purnell A-26-i).

The Effect of Changes in Transportation on Marketing Systems for Maryland Farm Products. (Purnell A-26-j).

Status and Trends of Agricultural Cooperatives in Maryland, 1930-37. (Purnell A-29).

An Economic Study of Land Utilization in Maryland. (Purnell A-32).

Land Use, Production and Market Price Opportunities for Fruit and Vegetable Production. (Purnell A-32-d).

A Land Classification Study in Maryland from the Standpoint of Productivity and Adaptability for Agriculture. (Purnell A-32-e).

An Economic Study of the Distillery Industry in Maryland. (State).

State Fiscal Capacity of Maryland and Other Selected States. (State).

## Agricultural Engineering

The Development of A Small Electric Milk Pasteurizer. (Bankhead-Jones R-3).

Investigations of Grain Storage on the Farm. (Bankhead-Jones R-6).

A Study of Egg Coolers and Cooling Conditions. (Bankhead-Jones R-7).

Artificial Lighting of Dairy Stables. (Bankhead-Jones R-8).

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Wheat—Hybridization and Selection. (Hatch B-39).

Barley—Hybridization for Smooth Awns. (Hatch B-41).

Hay, Forage and Pasture. (Hatch B-42).

Annual Legumes—Soybeans. (State B-43).

Sweet Corn—Seed Production and Breeding. (Purnell B-44).

Improvement of Permanent Pastures in the Several Soil Provinces of Maryland. (Bankhead-Jones B-49).

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Development of Diplodia zeae (Schw.) Lev. Stalk-Rot Resistant Dent Corn Inbreds. (Bankhead-Jones B-50-b).

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Efficiency of Soil Fertility Management. (Purnell O-33).

Hydrologic Studies with Reference to Soil Moisture Conservation, Soil Fertility and Flood Control. (Bankhead-Jones O-43).

A Bio-chemical-Biological Study of Means to Increase the Organic Colloidal Complex of the Soil. (Adams O-44).

A Study of the Chemical and Physical Changes Produced in a Soil by the Formation of the Organic Colloidal Complex (Adams O-44-a).

Tobacco Investigations (Cooperative with U. S. D. A.).

Production of Grain Sorghums. (State).

A Study of Methods of Estimating the Available Potassium in Maryland Soils by the Rapid Soil Testing. (State).

The Improvement, Production and Use of Rye in Maryland. (State).

Soil Fertility Studies at the Hopkins Farm. (State O-45).

A Study of the Availability of Rock Phosphate. (State O-45-a).

A Study of the Methods of Obtaining Total Exchange Capacity and Exchangeable Bases in Soils. (State).

A Study of the Factors Affecting the Boron Availability of Maryland Soils. (State).

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Periodic or Recurrent Ophthalmia of Horses and Mules—Field Studies. (State D-41).

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The Influence of Different Micro-organisms Upon the Quality of Frozen Egg Products. (State R-1-b).

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A Market Quality Study of the Del-Mar-Va Broiler and Fryer. (State).

The Nutritive Value of Concentrated Distillery Slops for Poultry. (State).

The Importance and Function of Dry Milk in Poultry Rations. (State).

## FINANCIAL STATEMENT—July 1, 1940, to June 30, 1941

| | FEDERAL FUNDS | | | | STATE FUNDS* | OTHER FUNDS* |
|---|---|---|---|---|---|---|
| | Hatch | Adams | Purnell | Bankhead-Jones | | |
| Balance June 30, 1940 | | | | | $18,396.08 | $11,201.15 |
| Appropriations 1940-41 | $15,000.00 | $15,000.00 | $60,000.00 | $28,550.48 | 75,634.00 | |
| Fees, Sales and Industrial Grants | | | | | | 47,497.88 |
| | $15,000.00 | $15,000.00 | $60,000.00 | $28,550.48 | $94,030.08 | $58,699.03 |
| Expenditures: | | | | | | |
| Salaries | 10,368.19 | 13,474.28 | 44,026.62 | 18,713.51 | 38,280.89 | 8,637.74 |
| Labor | 1,924.21 | 200.00 | 4,017.39 | 3,891.98 | 11,263.19 | 10,183.83 |
| Stationery and Office Supplies | | | 136.21 | 23.49 | 391.31 | 72.29 |
| Scientific Consumable | 83.98 | 608.25 | 1,810.29 | 736.37 | 1,486.54 | 643.68 |
| Feeding Stuffs | 31.00 | | 1,301.95 | 608.59 | 4,184.03 | 15,174.50 |
| Fertilizers | 1,182.81 | 35.92 | 675.80 | 484.96 | 750.57 | 978.61 |
| Sundry | 80.00 | 40.43 | 643.89 | 872.23 | 1,035.35 | 1,329.69 |
| Communication Service | 15.36 | 11.40 | 115.66 | 93.27 | 947.77 | 230.76 |
| Travel | 568.45 | | 2,848.82 | 967.04 | 2,560.28 | 1,262.09 |
| Transportation of Things | 3.25 | 18.00 | 50.40 | 9.93 | 137.74 | 36.49 |
| Publications | | | 1,170.97 | 23.90 | 1,352.78 | 43.61 |
| Heat, Light, Water and Power | 162.79 | | 349.32 | 222.53 | 1,245.51 | 693.39 |
| Retirement | | | | | 3,966.50 | |
| Contingent | | | | | 5,485.03 | 810.98 |
| Furniture, Furnishings, Fixtures | | | 218.17 | | 446.72 | 415.90 |
| Library | 6.10 | | 1.50 | | 435.91 | 10.00 |
| Scientific Equipment | 62.69 | 606.50 | 1,495.23 | 836.24 | 684.81 | 495.49 |
| Livestock | | | 154.50 | 66.50 | 45.00 | 2,603.86 |
| Tools, Machinery and Appliances | 465.00 | 5.22 | 807.33 | 549.94 | 1,314.78 | 1,380.46 |
| Land (Purchase and Rent) | | | 45.00 | 442.50 | 644.75 | 90.00 |
| Buildings and Improvement Land | 46.17 | | 130.95 | 7.50 | 345.00 | 915.81 |
| Total expenditures | $15,000.00 | $15,000.00 | $60,000.00 | $28,550.48 | $77,004.46 | $46,009.18 |
| Balances June 30, 1941 | | | | | 17,025.62 | 12,689.85 |
| Totals | $15,000.00 | $15,000.00 | $60,000.00 | $28,550.48 | $94,030.08 | $58,699.03 |

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*Including Bankhead-Jones Offset Funds.

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| " " | 360, Mar., 1934, | Maryland Wheat for Cake and Biscuit-Making. |
| " " | 361, Mar., 1934, | Part I, Potato Seed Maintenance. |
| " " | 363, May, 1934, | Natural Weed Fallow for Tobacco |
| " " | 365, July, 1934, | Roadside Markets in Maryland. |
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